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CENSUS REPORT ON CENTRAL STATIONS.

The report of the United States Bureau of the Census on electric light and power stations for the year 1912, with comparisons for the years 1907 and 1902, the preliminary figures of which are given in this issue, presents much of interest. The most notable thing about this report is the general increase in electrical development which has taken place during the decade in question, illustrating to what an enormous extent the application of electric power and the use of electrical energy for lighting have increased.

The annual energy output of all the central stations of the country, including both municipal plants and those operated by private companies, doubled between 1907 and 1912, and in the latter year was 4.6 times the output in 1902. The income of the stations did not increase so rapidly, showing that the average price for electrical energy decreased. The income in 1912 was 1.7 times the income for 1907 and 3.5 times the income for 1902. Expenses increased less rapidly than income, indicating that the lower prices to consumers were accompanied by greater returns to investors; but the rate of return on the investment is not indicated.

The average size of the power plants has increased at the same time that the number has increased. While the number of stations was increasing 44 per cent, the capacity increased 308 per cent, and the employees, 162 per cent. In 1902 the average kilowatts of generator capacity per plant was 335; in 1907 it was 575 and in 1912 it was 980. These figures confirm the tendency, of which every engineer is very well aware, that stations are growing in size and that there are frequent consolidations of smaller plants into one large one.

One notable feature of these statistics is the fact that the number of steam plants has decreased since 1907, although the capacity of such plants has nearly doubled. At the same time there has been an increase in the number of plants driven by water wheels and by gas and oil engines, especially the latter. The most notable increase given in the table, however, is the capacity of motors which are served from the central stations. The horsepower represented by this service has increased 843 per cent since 1902 and was 2.5 times as great in 1912 as in 1907. This is a striking and convincing evidence of the growth of the industry.

As regards electric lighting, it is to be noted that the number of arc lamps in service has decreased since 1907, while at the same time the increase in incandescent and other varieties amounted to 82 per cent. With

the advent of the half-watt tungsten lamp, which will be a more serious competitor of the arc lamp than anything hitherto available, we may expect this tendency in electric lighting to be emphasized in the next few years.

It is notable that municipal plants have increased more rapidly in number than those privately owned, but the tendency in this direction is less marked during the second five years of the decade than during the first five. However, during the second five years municipal plants increased nearly 25 per cent, while privately owned plants increased only 6 per cent. The municipal plants now number 30 per cent of the total. If compared in capacity or output, however, the percentage would probably be less than this, but the necessary figures for such a comparison are not given in the report. The diminishing rate of increase in municipal plants (the increase from 1902 to 1907 was over 53 per cent) can probably be attributed to the more enlightened attitude of the utility managers in dealing with the public. The strenuous efforts which are made nowadays to give the best possible service, the readiness to adjust complaints, the policy of managing a utility as a quasi-public institution in which the citizens of any community should take an interest and have this interest met by a co-operative spirit, together with a rapid advance in the regulation of public utilities by state commissions, should have a marked tendency in limiting the extension of municipal ownership in the future.

REPRODUCTION VERSUS DEPRECIATED VALUE.

In rate cases before public utility boards one element of importance in arriving at what is a fair charge for service is obviously the return which it will yield, and all authorities are agreed that no rate can be fair unless it at least yields a return on the value of the property or on the investment, or some such figures. But when one comes to the determination of what is the fair value of the property, one gets at once into the difficult part of the case. An illuminating discussion of this question forms a part of the proceedings of the Haverhill (Mass.) Gas Light Company vs. Barker, et al, before a master in defense of the existing rate schedule against an order of the Massachusetts Gas and Electric Light Commission, reducing the company's price. The company maintains that reproduction rather than depreciated value is the proper basis upon which to adjudicate rates and its reasons are set forth so clearly that they deserve mention.

If one undertakes to ascertain, as many courts have done, in such cases, just what is the present value of the property, regarded as so many pieces of land, so many machines, or so many miles of pipes or lines, and what it would cost to put in new equipment, and then tries to figure out how much ought to be deducted from that cost new, because of the varying age of the different parts of the property, one soon gets into the realm of speculation. Of course, efforts are made to figure out the amount of depreciation fair to accept, but after all, such efforts are never very satisfactory. On the other hand, it is an unquestioned fact that although, of course, during every day the life of particular parts of the property is shortened, yet the plant often improves in utility and efficiency with use. The parts of the plant become co-ordinate. Again, if one undertakes to fix the rate on the basis of a depreciated value, which fluctuates up and down more or less, it is obvious that if the rates are flexible they will be varying every year and almost every day, unless one adopts an average allowance for depreciation. In some way or other the actual depreciation from year to year must be ascertained and the company allowed to earn an amount representing the actual depreciation plus a fair return on the depreciated values of the property in addition to operating expenses.

The task of trying to determine the exact amount of depreciation occurring from year to year is difficult, and is not a matter of mathematical certainty. It does not depend alone on the life of parts. No part of a plant has any really fixed life. Averages are estimated, which are all right for average funds, but in reality the plant is renewed mainly because of obsolescence or inadequacy, equipment being discarded even though fit for operation. On the other hand it is fairly easy to ascertain the cost of reproduction. The prices of materials are well known to experts, and the cost of reproduction new is not a difficult matter to determine. It is also possible for an expert to estimate with reasonable accuracy the amount of money which a company would have to set aside from the beginning to provide an average fund sufficient to maintain the property and renew it as necessary.

THE COST OF ELECTRICAL ENERGY AT THE SOURCE.

The paper presented by Mr. H. M. Hobart at the midwinter convention of the American Institute of Electrical Engineers on "The Cost of Electricity at the Source" aroused a storm of protest on account of the figures which were used in computing the cost of a kilowatt-hour at the power house when energy is generated in bulk at a steam plant. Mr. Hobart admitted that his fixed charges were taken too low to represent possible practice at the present time. He defended his figures for cost of installation against the onslaught of his many critics. Certain it is that the figures used would not serve for the construction of a plant at any point where land is very valuable, as in a large city, and could at best only correspond to a plant erected at some remote point. Since the largest demands of power are, however, in thickly populated districts, this would represent a possible case only if the plant were intended to supply some large industry in an isolated location. This industry must be one which carries on a continuous op-

eration in order to attain such high load-factor as Mr. Hobart assumed. It is not likely, therefore, that the specific figures used in the computation would apply to any actual power development, and unit costs of the values obtained are not likely to be reached in practice.

The two important lessons which might be drawn from Mr. Hobart's paper, however, were almost entirely ignored in the discussion. One of these is the fact that the cost of the actual generation of power is but a small fraction of the cost of delivering it to the consumer at the point of utilization. Even in densely populated districts where the energy is generated within a short distance of the load, distribution costs are found to exceed the cost of generation and to these are generally to be added other costs of an incidental nature, as well as the cost of the commercial department of the supply company, which is a necessary factor in securing a load. When, in addition to this, low load-factor, low power-factor and other disadvantageous elements must be reckoned with, it is not surprising that the consumer usually has to pay for his energy several times the cost of mere generation.

The other point to be mentioned is the bearing upon the relative cost of electrical energy generated by steam and by water power. Under certain conditions the cost of electric power at the source is less when generated by one means and under other conditions it may be less for the other. Since investment costs are higher for a hydroelectric plant, the unit cost of energy appears more favorable for this case when the load-factor is high. Since, however, a steam plant can usually be located near the point of consumption, whereas a transmission line may be a necessary feature of the hydroelectric plant, and since the cost of generation is such a small part of the total cost of supply, it is evident that the advantage of a water-power plant over a steam plant can be great only where the conditions are especially favorable. The popular view that a water-power plant inherently connotes a supply of cheap energy to the consumer, a supply which is necessarily cheaper than where a steam generating plant is used, is shown to be a delusion which does not correspond with the actual facts.

HETEROCHROMATIC PHOTOMETRY.

Heterochromatic photometry, or the comparison of intensities of light sources of different colors, is a problem for the standardizing laboratory. For if it can be successfully worked out here, secondary standards may be easily established for any color and commercial measurements carried out through the comparison of light of approximately the same color. The common methods of photometry are based upon equality of brightness, and when applied to lights of different colors meet the obstacle that in judging equality of brightness which is intermingled with differences in color, different observers use different criteria and the same observer may do so at different times. Hence the results show unsatisfactory variations.

This difficulty has led to a search for other methods of photometry where different colors are involved, and up to the present time the method of flicker has seemed to be the most promising. It also, however, has certain inherent defects arising from the physiological properties of the eye, so that it cannot be said that as yet we have any wholly satisfactory method. It is found that the rate of flicker necessary is such that the eye is not exposed to the stimulus long enough to give a sensation corresponding to the full intensity of the stimulus; the decrease in apparent intensity due to the short exposure of the retina is not in the same proportion in all cases, since it depends not only upon the intensity of the light but upon its color; moreover, different rates of flicker are necessary for different colors and different intensities. For these reasons there is in the method of flicker a characteristic underestimation of the intensities of red and yellow light and an overestimation in the case of green and blue. While the uniformity of results is greater than with the method of equality of brightness, the results do not agree with that method, which it must be admitted is based upon a better principle and is limited in its application only by the uncertainty of personal judgment.

The defects of the method of flicker are emphasized in a paper read before the Philadelphia Section of the Illuminating Engineering Society and abstracted in our last issue. At the same time the authors, Dr. C. E. Ferree and Miss G. Rand, proposed a method of color photometry which avoids the difficulties of both the method of flicker and the method of equality of brightness. It has, moreover, a sensitivity about as high as the method of flicker. This method depends upon the phenomenon that the apparent difference in luminosity between a white and a gray surface depends upon the intensity of illumination of the surface, and this effect is found to be accentuated in the peripheral portions of the retina, which are consequently made use of in the observations. A match in luminosity is obtained between a test object, in which the apparent luminosity is dependent upon contrast with a white surface, and an adjustable comparison object under a known intensity of illumination. This equality disappears when the illumination is altered; consequently a test of equal illumination under a second and unknown source is the retention of the match between the test object and the comparison object, and this is independent of the color of the second source. Fuller details of this method, with a description of the apparatus, are given in the abstract referred to above.

This proposal seems a valuable one and one which should be thoroughly tested out under the conditions which obtain with the exact comparison of standard sources, as it furnishes great promise of solving this difficult question. Since it obviates the difficulties of the other methods, it only remains to be seen whether its accuracy is sufficient and whether it introduces any new difficulties in the situation. If these questions are satisfactorily answered the method may well become a standard one.

United States Government Exhibits at the Panama-Pacific Exposition.

The United States Government is preparing a series of elaborate exhibits for the Panama-Pacific International Exposition next year. It is said that these exhibits will be more comprehensive than any similar display ever made before. Exhibits will be made by various Government departments and will be distributed among the various exposition buildings in accordance with the class to which they belong.

Among the Government departments which will make exhibits are the United States Treasury, the War and Navy Departments, Post-office Department, Life Saving Service, the Fish Commission, Bureau of Standards, Bureau of Mines and the Geological Survey. An exceptionally interesting exhibit will be the very complete model, 500 feet long, of the Panama Canal.

Jovian Meeting at Columbus, Ohio.

The Jovians of Columbus, O., had one of the best meetings of the year on March 6, at the Kaiserhoff, with an attendance of 52 members. The star feature was an address by W. D. McKinney, superintendent of the Telephone Despatch Company, Boston, Mass., back in 1881-3, and later of the New England Telephone & Telegraph Company. As this period was the very beginning of commercial telephony, he was able to tell of many things not dreamed of in the experience of present-day electrical men, but which were a nightmare to those who were trying to establish public service with imperfect knowledge and crude appliances. Mr. McKinney introduced to the telephone world John J. Carty, now chief engineer of the American Telephone & Telegraph Company. He was picked out from a telegraph-operator job paying $20 a month, and made Mr. McKinney's assistant. Mr. McKinney is a personal friend of Alexander Graham Bell, Thomas Edison and other telephone men, and is himself the inventor of several telephone devices.

March Meeting of Philadelphia Section, Illuminating Engineering Society.

The next meeting of the Philadelphia Section of the Illuminating Engineering Society will be held on March 20, at the Engineers' Club, 1317 Spruce Street, Philadelphia, at 8 p. m. F. D. Bartlett will present a paper on "Lighting and Signaling Systems of Subways," and Prof. James Barnes will present "The Sun—The Master Lamp."

Buffalo Electric Show.

An electric show has been in progress in the Elmwood Music Hall, Buffalo, N. Y., during the present week, and closes at 10:30 p. m. this evening. The show is under the management of George H. Dreybus, and was organized by the Jovian League of Buffalo, which caused the Buffalo Electric Show Company to be incorporated. The chairman of the Executive Committee is E. D. McCarthy, and the secretary is Harry S. Hilliker. The decorations and illumination were in charge of W. D'A. Ryan.

The local electrical interests took an active part in the show and prominent among the exhibits were those of the Robertson Cataract Electric Company, H. I. Sackett Electric Company, the Federal Telephone & Telegraph Company, the Buffalo General Electric Company, the New York Telephone Company, and the local branch of the Jovian Order.

The Naval Reserves of New York State operated a wireless station in the building.

Among other exhibitors were the following: Buffalo Forge Company, Ericsson Manufacturing Company, Federal Sign System, McCarthy Brothers & Ford, Cataract Power & Conduit Company, Western Electric Company, W. C. Jaynes Electrical Company, J. C. Sterns Electrical Company, Holtzer-Cabot Company, Johnson-Wahle Electric Company, Frantz-Premier Suction Cleaning Company, Tower Electric Sales Company, Buffalo Electric Contracting Company, Burroughs Adding Machine Company, Thordarson Electric Manufacturing Company, National Carbon Company, Sterns Electric Equipment Company, American Steel & Wire Company, H. J. Wood & Company, J. N. Adam & Company, William Hengerer Company, Buffalo Electric Company, Flexlume Sign Company, Thomas Cusack Company, Monarch Refillable Fuse Company, Economy Fuse & Manufacturing Company, J. G. Clemens & Company, The Electric Shop.

Safety First Movement Take up by Utah Light and Railway Company.

The Utah Light and Railway Company has gotten out a neat button bearing on its face the company's monogram and the words, "Safety First." These buttons are presented by the company to the members of the "Safety First" committee, consisting of 25 employees of the company. This committee is changed at regular intervals. The retiring members retain their buttons, thus becoming ex-officio members of the Safety Committee.

Large Steam Power Plants to be Discussed at Chicago Dinner of Mechanical Engineers.

The Chicago Section of the American Society of Mechanical Engineers will hold its third dinner meeting at the Hotel Sherman, Chicago, on the evening of March 18. This meeting is expected to be an exceptionally important one on account of the subject to be discussed and the prominence of the speakers.

The subject will be "Large Steam Power Plants." The committee in charge of arrangements announces that it is expected there will be present at the meeting the following men in responsible charge of some of the largest steam power plants in this country. The speakers will be: John F. Sparrow, New York Edison Company; I. E. Moultrop and James B. Andrew, Edison Electric Illuminating Company of Boston; J. W. Parker, Detroit Edison Company; John Hunter, Union Electric Light & Power Company, St. Louis; and W. L. Abbott, Commonwealth Edison Company, Chicago.

Preceding the meeting members of the Section will be the guests of the Commonwealth Edison Company in inspections of the Fisk Street and Northwest stations of the company. All those desirous of attending the dinner should notify the committee in charge, or the chairman of the Section, Paul P. Bird, 120 West Adams Street, Chicago.

Big Rejuvenation to Be Held at Louisville.

Over 100 candidates for initiation into the Jovian Order have been listed for the rejuvenation which will be held at Louisville, Ky., March 17. The rejuvenation will be a joint affair, Louisville and Lexington, Ky., and Evansville, Ind., having part. The Seelbach Hotel has been selected as the place, a banquet following the rejuvenation, which will be participated in by a number of high officers of the order, including Reigning Jupiter W. N. Matthews, of St. Louis. James Clark, Jr., of Louisville, statesman for that district, and C. J. Eaton, of Lexington, statesman for the Bluegrass section of Kentucky, are in charge of arrangements. The interest in the event is increased on account of the fact that the rejuvenation is the first ever held in Kentucky.

Predicts Success of Trans-Oceanic Radio-Telephony.

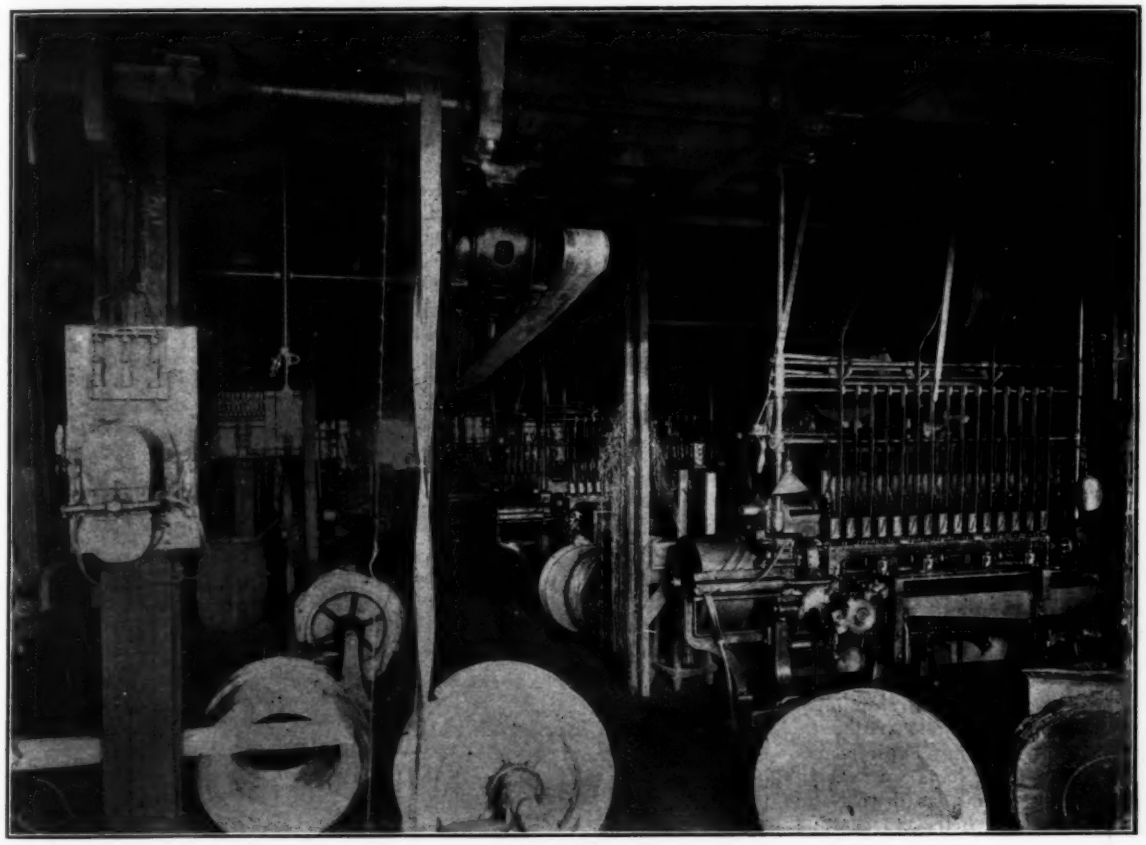
William Marconi, while delivering a lecture in Rome, before all the nobilities of Rome and a great throng of the public generally, predicted the early success of radiotelephony, declaring that the human voice could be projected across the ocean by this method more quickly than a message could be sent by cable.

Electricity in Brass and Iron Bed Manufacturing.

In the manufacture of brass and iron bed steads there are comparatively few operations that are of a special nature. Tube drawing and cutting and some of the special bending machines are perhaps common only to this industry but aside from these the conditions encountered in applying electric motor drive are similar in every respect to the ordinary machine shop.

In the manufacture of springs and sanitary couches the conditions are, of course, entirely different as the operations involved are different in practically every plant. In fact, most all of the larger establishments in this industry have designed and manufactured their own looms and auxiliary machines. It is obvious, therefore, that only general practice can be commented upon, the details as to sizes and types of motors, methods of applying, etc., having to be worked out by the power engineer for each case.

In the manufacture of brass and iron bed steads, springs, couches, etc., the conditions encountered in applying electric motor drive are almost identical with those to be met in electrifying ordinary machine shops. In the weaving departments, however, special problems must be solved as the practice varies in every establishment.



20-Horsepower Motor Driving Group of Bed-Spring Weaving Machines.

Briefly the operations in making bed springs, etc., are as follows: Wire in loose coils, as received from the mills, is usually first conveyed to the spooling room, either by means of conveyors, or manually. These loose coils are then rewound on special spools, to insure a continuous, easy feed for the looms. From the spools the wire is fed to link-making machines and then to the looms, where the springs are woven.

Aside from these departments of a bed-manufacturing plant the conditions are the same as in machine shops. A review of some of the salient features to be considered in soliciting the adoption of electric drive for plants in this industry may therefore be pertinent.

The application of motors for driving machine tools in a manufacturing establishment may be divided into four classes: (1) Group drive at a constant speed. (2) Individual drive at a constant speed. (3) Individual drive at an adjustable speed. (4) Cranes, hoists, elevators, etc. The selection of the type of motor and the question of groups of individual drive depends upon the number of factors, viz., nature of the work, size or location of machine tool, percentage of time that machine is in operation.

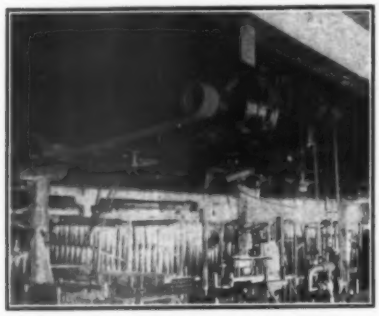
In determining on the motor outfit for operating machine tools, one of the most difficult questions to decide is that of group or individual driving, and the most general solution is a combination of these two methods. The ideal method, and the one coming more and more into general use is to have the motor form an integral part of the machine. This method entirely eliminates belting and shafting, both main line and jack shafts. The saving in cost of these mechanical transmission parts partially compensates for the installation of motor and controller.

The slip of belts introduces an uncertain factor in power supply which is entirely absent with individual motor drive. Furthermore, with individual motor drive the power delivered to the driven machine is automatically controlled and, in case of heavy demands, may greatly exceed the rated power of the motor, even for considerable periods of time. Thus a motor-driven machine is always capable of maximum production, while with belt drive and poorly adjusted belts the machine frequently balks before the full capacity of the machine is reached.

The even and easily manipulated speed control of machines individually driven increases their productive capacity to a very material extent.

The advantages of individual motor drive may be summed up as follows:

(1) Better control and greater range in speed and closer speed regulation. The average increment of speed increases in a belt driven machine tool is about 50 per cent. In an adjustable-speed motor it is 10 per cent to 20 per cent.



15-Horsepower Motor Driving Drills.

(2) Increased output and decreased cost of production, due in part to increase in amount of power available in motor over that transmitted by belts.

(3) Increased light and cleanliness by elimination of dust and belting.

(4) Greater ecenomy in transmission, especialy when tools are running only part of the time, as there is no loss due to driving belts and shafting when tool is idle.

(5) Reduced cost of repair and maintenance, owing to absence of shafts, hangers, pulleys and belts.

(6) Head foom for cranes.

(7) More economical disposition of floor area and more convenient location of tools. Machines can be placed to best possible advantage with regard to light and sequence of operation. Additional tools can be readily added to equipment or location changed without any changes which are necessary in shafting when belt-driven tools are used.

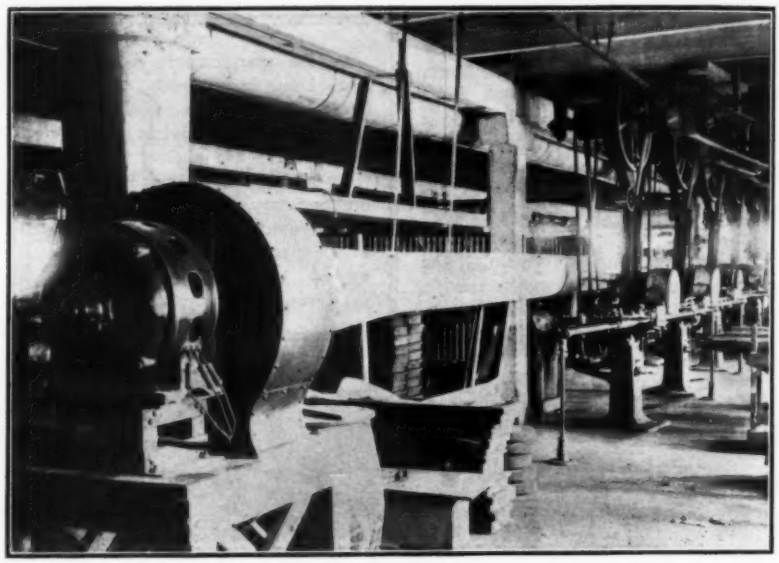
(8) Use of portable tools which permits of bringing one or more tools to the work and thus performing several operations at the same time on a large casing.

(9) Reduced cost of buildings, as absence of shafting simplifies construction.

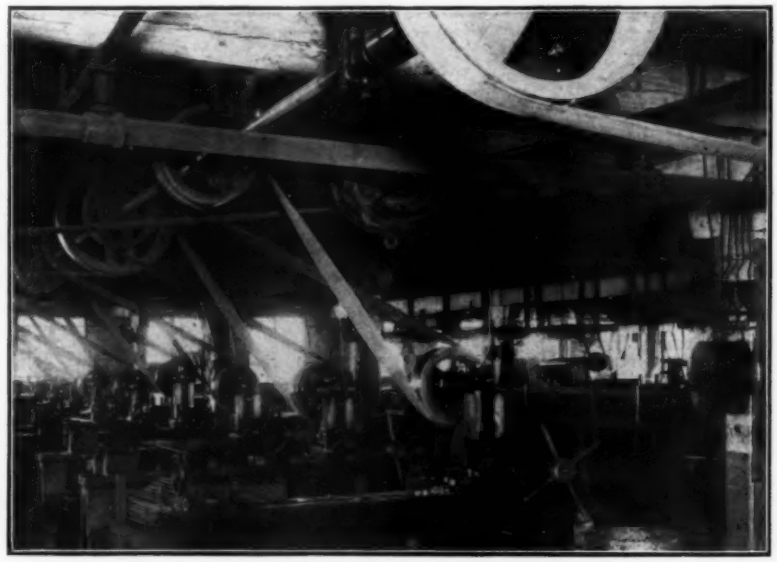
(10) Reduced cost in installation in many cases, especially for tools in isolated positions where expensive shafting and hangers would exceed cost of applying individual motors.

(11) Greater reliability and steadiness of power and freedom from stoppage of a number of tools, as in the case of a hot bearing or broken belt.

The most important advantage to be gained is a speed regulation adapted to the work. The convenience of securing the desired speed for maximum cutting, when electric drive is used, will result in a material increase in output. On most of the belt-driven machine tools the average increase of speed per step is about 50 per cent. For instance, the spindle speeds might run as follows: 10, 15, 23, 53, 70, etc. It was found by closely watching the work on these machines that while in many cases the speed was evidently too low for a given piece of work, yet the increase of speed to the next step was so great that the tool steel could not stand it. The controller used is such that the average increase of speed per step is about 10 per cent, i. e., 10, 11, 12.1, 13.3, 14.6, 16.1, etc. It will therefore be seen that the output per machine and therefore per man, will be considerably increased, since it is

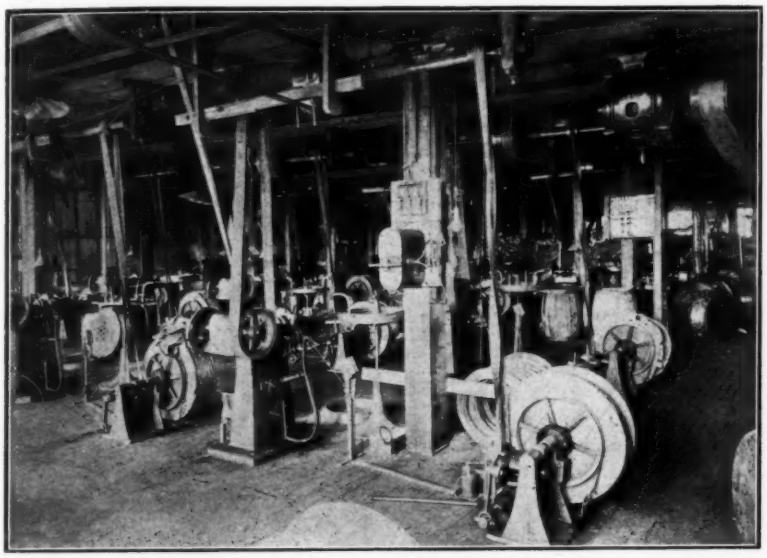


15-Horsepower Motor Driving Exhaust Fan.



30-Horsepower Motor Driving Tube-Cutting Machines.

possible to more nearly approach the working limit of the tool steel. In every shop the labor item is the largest single item of expense, and the saving of a small per cent of a man's time will amount to quite an item at the end of a year.



20-Horsepower Motor Driving Link-Making Machines.

Electric drive provides a steady power and permits of great ease of speed regulation. The controller can be placed at the most convenient point, or, if advisable, two or more handles can be provided at different points, one being arranged to travel with the tool carriage. With the belt-driven machine more or less time is always lost in throwing a belt, and a negligent operator will not always take advantage of a change of speed on account of the exertion required to make the change.

It allows head room for cranes. A traveling crane can be used to great advantage in a machine shop, particularly for serving the larger machines. The effect of the electric crane on the economy of the shop cannot well be over estimated; though it is difficult to express in figures this economy.

With plenty of light and the absence of dust and dirt caused by shafting and belts, a workman surely ought to be, and usually is, inspired to do better and more efficient work.

The machines can be placed to the best possible advantage and, if it should be necessary to rearrange them, it can be readily done.

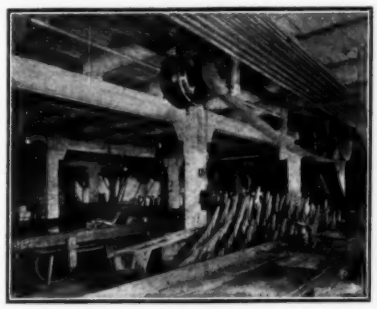
Five-Horsepower Motor Driving Lacquer Machines.

If it is necessary to work a few machines overtime, a lot of power will not be wasted in running a shop full of shafting.

When a machine is not running it is not using power, whereas, in a belt-driven shop, the shafting is always running. Experiments have demonstrated that in an ordinary machine shop the shafting requires as much or more power than the power required to run the machines.

The absence of shafting simplifies the construction of the building.

When changing over from lineshaft drive to individual motor drive in bed manufacturing plants as in others, the question arises whether to equip the old line-shaft driven machines with motors or to install new motor-driven machine tools. The old machines are not as strong in construction as new tools designed for motor drive, nor are they equipped with the latest devices by means of which the time required to make adjustments can be greatly reduced. Owing to weaker construction old machines cannot be made to remove metal as rapidly as machines built with this point in view. The old machines are also more or less worn and not as accurate as new machines. A concrete example will show a method of arriving at a decision between attaching a motor to an old machine and purchasing a complete new motor-driven equipment.



15-Horsepower Motor Driving Tube-Drawing Machines.

The case taken for consideration involves the modification or exchange of a 72-inch vertical belt-driven boring mill, so as to obtain a greater output at lower cost per unit of product. This mill, the original cost of which was $3,200, has been in use five years. The hourly overhead operating charge has been determined at 91 cents. The machinist receives 35 cents an hour for 54 hours per week (2,808 hours per year). The total earnings for the year from this machine amount to $4,200. The operating expenses for the year are as follows:

Overhead	0.91 × 2808 =	$2,555.28
Wages	0.35 × 2808 =	982.80
Total		$3,538.08
Net profit $4,200 — $3,538 =		662.10

The depreciated value of this tool on a basis of 10 per cent reduced balance is 66

Brass-Bed Manufacturing Data.

The term load-factor is used in these data in such a sense that a load-factor of 100 per cent represents the use for 24 hours every day of power corresponding to the rated capacity of the motors connected. An operating-time load-factor of 100 per cent represents the use of the rated capacity of the motors for the running hours per day specified for each installation.

Company manufacturing a complete line of high grade brass and iron beds and sanitary couches. There is a total of 125 men employed working 10 hours per day.

Total connected horsepower, 153. Total number of motors installed, 11. Average kilowatt-hours per month, 10,112.

Kilowatt-hour consumption for 12 months:

Month	Kilowatt-hours	Month	Kilowatt-hours	Month	Kilowatt-hours
January	11,100	May	8,920	September	8,200
February	8,680	June	7,480	October	10,610
March	9,670	July	7,880	November	11,080
April	16,740	August	9,380	December	11,610

Load-factor, 12 per cent; operating-time load-factor, 26 per cent.

MOTOR INSTALLATION.

The following is a list of the motors installed with their respective drives. The supply source is three-phase, 60 cycles, 220 volts.

No.	Horse-power.	Speed R. P. M.	Application.
1	30	850	Belted to a line shaft driving a battery of nine tube-cutting machines.
1	20	1,120	Belted to a line shaft driving five bed-spring weaving machines; and four link making machines.
1	5	1,120	Belted direct to one tube-drawing machine.
1	7.5	1,700	Belted to a six-foot shaft (two hangers) and two countershafts (four hangers) driving one Beach Manufacturing Company jig saw; one Bentel & Margedant 24-inch pattern lathe.
1	15	1,120	Belted to 120 feet of shafting (22 hangers) and 12 two-hanger countershafts driving one Bradford 14-inch engine lathe; one Jones & Lamson three-inch turret lathe; one Columbia 30-inch boring mill; one Lodge & Shipley 18-inch lathe; one Binssee horizontal boring mill; one Lodge & Shipley 20-inch combination turret and engine lathe; one Laponite No. 2 broaching machine; one Jones & Lamson 2.25-inch turret lathe; one Prentice Tool & Supply Company 16-inch lathe; one Dresses 18-inch turret lathe; one six-inch forming lathe; one Jones & Lamson 2.25-inch chucking lathe; one Baker Brothers 24-inch double-machine drill; one polishing lathe (two 12-inch by three-inch wheels); one 24-inch exhaust fan; three eight-feet by 12-inch tumbling barrels; one automatic punch press (32-inch flywheel, six-inch by 2.5-inch rim); one Woodward & Rogers tapping machine; one G. W. Heartley punch press (19-inch flywheel, four-inch by two-inch rim); one C. S. Shuster wire straightener (18-inch flywheel, 4.25-inch by 2-inch rim); one double emery wheel (9-inch by .5-inch wheels); one No. 1-C punch press (12-inch flywheel, 2-inch by 2-inch rim); two two-spindle special horizontal drills; one thread rolling machine; one Fox rim-drilling machine; one Rockford 18-inch drill; one five-ton screw press; one Fairbank 12-inch sensitive drill.
1	5	1,700	Belted to a 14-inch shaft (four hangers) and three two-hanger countershafts driving one 16-inch cut-off saw; one Witherby, Rugg & Richardson 12-inch jointer; one Hermance 12-inch combination rip saw and horizontal drill; and one 20-inch pony planer.
1	7.5	1,700	Belted to a 30-foot shaft and a two-hanger countershaft driving one J. F. Coffman miller; one eight-inch sensitive drill; one E. W. Bliss No. 2.5 punch press (24-inch flywheel, five-inch by three-inch rim); one Standard Machinery Company No. 2-C punch press (18-inch flywheel, 3.5 by 2.5-inch rim); one 18-inch drill press; one Mossberg No. 2-C punch press (18-inch flywheel, 3.5-inch by 2.5-inch rim); one Rockford 18-inch drill.
1	15	1,120	Belted to a nine-kilowatt 12-volt 750-revolutions-per-minute generator.
1	40	850	Belted to 180 feet of line shafting and five two-hanger countershafts driving one 150-light 110-volt direct-current generator; one 2,000-pound freight elevator; four Rockford 18-inch drills; two Cincinnati two-inch plain millers; two 12-inch sensitive drills; one Bradford 16-inch lathe; one Michigan Machinery Company size 21 punch press (24-inch flywheel, four-inch by two-inch rim); and three Laquer machines.
1	0.5		Belted to a 16-inch exhaust fan.
1	7.5	1,700	Belted to line shafting driving one Porter 24-inch lathe; one Bradford 22-inch lathe; one Steptoe 16-inch shaper; one 10-inch tool grinder; one V and O No. 3 punch press; two special rolling machines; one E. W. Bliss No. 2½ press.

per cent of its first cost. If a motor is installed the investment appears as follows:

Value of tool $0.66 × 3200	=	$2,112.00
Cost of motor, gears, controller, wiring, etc.	=	550.00
Total investment		$2,662.00

The hourly overhead charge of 91 cents includes interest and depreciation at 16 cents an hour; the overhead charge exclusive of interest and depreciation will therefore be 75 cents an hour. The depreciation on the new investment for the remaining five years' life of the tool will be 20 per cent per year, making the charge for interest and depreciation 26 per cent. The operating cost of the old tool with motor drive is, therefore,

Overhead (exclusive of interest and depreciation) $0.75 × 2808	=	$2,106.00
Interest and depreciation, 26% of $2,662	=	692.12
Wages, 0.35 × 2808	=	982.80
		$3,780.92

Assuming 10 per cent increased earnings, due to adoption of individual motor drive, makes the total earnings:

$4,200 + $420 = $4,620.00

The net profit is then

$4,620 — $3,780.92 = 839.08

or 31.5 per cent interest on the investment of $2,662.

The corresponding figures, based on the installation of a new machine tool with individual motor drive, are approximately as follows:

Cost of new tool	=	$3,400.00
Cost of motor, etc.	=	270.00
		$3,670.00
Scrap value of old tool at 5%		160.00
Investment		$3,510.00
Overhead operating charge: $0.75 × 2808 =		$2,106.00
Wages as above		982.80
Interest and depreciation for 10 years (depreciation 10 per cent, interest 6 per cent) 16% × $3,510 =		561.60
Total		$3,650.40

Assuming 25 per cent increased output for the year, the total earnings become:

125 per cent × $4,200 = $5,250.00

Net profit is then $5,250 — $3,650.40 = $1,599.60

or 45.3 per cent on the investment.

The above figures show that for the conditions given, approximately 14 per cent greater return on the investment is gained by installation of a complete new tool. It is evident, therefore, that although a somewhat greater capital is required for the new installation, it is by far the better investment. It is also probable that the old machine tools would not last more than five years after the changes were made, whereas the new tool will give good service for at least double that period. Furthermore, the new machine has the added advantage of being in first class condition, thus insuring greater accuracy of workmanship and less liability to accidental delays.

Information relative to the motor installation in a plant purchasing power is given in the accompanying data sheet.

Commercial Practice
Management, Rates, New Business

New Jersey Utility Companies Advertise Service Conditions in Storm Period.

The recent severe snowstorm along the Atlantic Coast, centering in New York, New Jersey and vicinity, brought multiplied hardships to the public-utility companies serving this territory, with a total loss of many thousands of dollars. Throughout the state of New Jersey, practically every city and town, including Newark, Trenton, Camden, Jersey City, and surrounding districts, electric-lighting and power service was discontinued from March 1 to 3, due to damage to overhead distributing systems and the shutting off of energy as a precaution against further damage. Telephone lines were likewise effected, making attendant frequent interruptions in connections and service.

The forethought and consideration accorded consumers by the Public Service Company, which serves this territory, is shown by the accompanying reproduction of an advertisement which was run by this company in all important newspapers in the State during the storm period. These notices were opportune; informing consumers of the reason for interruptions in service and requesting their indulgence. They served to eliminate unnecessary inquiries, and at the same time earned for the company increased good will and respect of the various communities.

The New York Telephone Company also published similar advertisements in all papers reaching its subscribers. Under date of March 5 the New Jersey newspapers contained the following pertinent announcement:

"To the Public: The storm of Sunday and Sunday night, consisting of a very heavy fall of wet snow and sleet, accompanied by excessive high winds, was the most severe experienced by the wire-using companies in the State of New Jersey during the last fifteen years.

"Repairs are now under way, and will be completed as promptly as conditions will permit.

"In the meantime, we ask the indulgence of those subscribers whose service has been affected."

Light and Power Service hard hit by the storm

Not in many years have the elements wrought such havoc with the electric light and power service as during the storm just past.

Snow, temperature and low barometer produced most unusual conditions, causing wires to break and felling poles so as to put entire circuits and lines out of commission.

Before the storm receded all the resources of Public Service were brought into play to repair the damage, the cost of which will run into many thousand dollars.

Every effort is being directed to restoring normal conditions and rapid progress is being made.

We ask our patrons to show, for the next few days, that spirit of forbearance which the severity of the storm would justify and we give our assurance that we are doing everything within the power of human agencies to overcome the damage wrought

PUBLIC SERVICE ELECTRIC COMPANY

Newspaper Advertisement of Public Service Company After Recent Eastern Storm.

Reduced Rates in Massachusetts.

The Central Massachusetts Electric Company, which supplies electricity to the towns of Monson, Palmer, Warren, West Brookfield and Wilbraham, has notified its customers in Brookfield that beginning April 1, the maximum price of current will be 16 cents in place of 17 cents per kilowatt-hour, with a reduction of one cent per kilowatt-hour if bills are paid before the tenth of the month. The company entered this territory about a year and a half ago and has secured a constantly increasing number of customers.

Central-Station Power for Woolen Mills.

A 20-year contract has been signed between the Central Maine Power Company, Augusta, Me., and the American Woolen Company, for the supply of 385 horsepower to the mills of the latter company at Skowhegan.

Electric Rates in South Pasadena Reclassified and Reduced.

An ordinance has just been passed regulating the price of electricity in South Pasadena, Cal., this to go into effect May 1, 1914. The reduction is made on electric service for domestic use and will save the residents of the city about $20,000 annually. For rate-regulating purposes the electric service has been divided into five classes for lighting and into seven classes for power, dependent entirely upon the amount of current used. The classes and reduced rates are as follows: For lighting—class A, 7 cents per kilowatt-hour; class B, 6 cents; class C, 5 cents; class D, 4 cents; class E, 3 cents. For power—class A, 5 cents; class B, 4.5 cents; class C, 3 cents; class D, 2.5 cents; class E, 2 cents; class F, 1.8; class G, 1.2. These rates average a 20-per-cent reduction. The Pacific Light & Power Company serves the territory in and around the city.

Growth of the Western States Gas and Electric Company.

The Stockton Division of the Western States Gas & Electric Company was formed by the combination of the Stockton Gas & Electric Corporation and the American River Electric Company in December, 1910, by H. M. Byllesby & Company. During the period between April 1, 1911, and January 1, 1914, there was an increase of 4,417 electric customers or 120 per cent and an increase of 2,433 gas customers or 59 per cent, whereas Stockton's population increased only 29 per cent in the same period. At the time Byllesby & Company assumed management there was one electric meter in service to each 9.4 of population, today there is one electric meter for every 5.48 of population. These figures of meter ratio include the fifteen other communities served.

During the period of Byllesby management the property has been entirely rehabilitated, part has been reconstructed and a great deal has been accomplished in the way of extension, addition and improvement. Great strides have been made promoting the use of electric power for irrigation. At the present time the total load of this nature served by the company amounts to approximately 5,000 horsepower. Following is a comparison of the electric connected load as of December 31, 1913, with that of April 1, 1911, covering a period of two years and nine months:

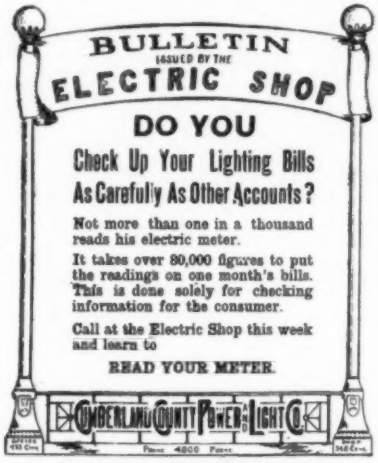
	Dec. 31, 1913	Apr. 1, 1911	Increase	Per cent Increase
Total number of customers	8,091	3,674	4,417	120
Kilowatts lighting load	7,355.4	3,487.6	3,867.8	111
Kilowatts city lighting load	253.2	201.2	52	25.9
Horsepower motors connected	14,699.2	3,386.5	11,312.7	330
Total kilowatts all purposes	18,574.1	5,974.8	12,599.3	211

(Note: These figures are exclusive of railway load, which averages 700 kilowatts.)

Customers Urged to Read Their Meters.

The Cumberland County Power & Light Company, Portland, Maine, has adopted the policy of urging the customers to form the habit of reading their electric meters, and is inserting advertisements in the local newspapers, which are printed in the form of daily bulletins, in which this subject is discussed. The company asserts that not more than one customer in a thousand reads his meter, and offers to explain how to read the measuring devices to all who will call at the company's office.

The accompanying illustration shows one of a series of newspaper advertisements used in this campaign to educate the company's customers. It


BULLETIN
ISSUED BY THE
ELECTRIC SHOP
DO YOU
Check Up Your Lighting Bills
As Carefully As Other Accounts?
Not more than one in a thousand reads his electric meter.
It takes over 80,000 figures to put the readings on one month's bills. This is done solely for checking information for the consumer.
Call at the Electric Shop this week and learn to
READ YOUR METER.
CUMBERLAND COUNTY POWER & LIGHT CO.

Cumberland Company Advertisement.

is believed that if patrons get into the habit of reading their own meters there will be fewer unnecessary complaints made.

Union Gas & Electric Accepts Temporary Rate Ordinance.

The Cincinnati council has passed and the Union Gas & Electric Company has accepted a temporary rate ordinance for electric current to be effective for six months. The rates are substantially the same as those now in effect, a maximum rate of 10 cents a kilowatt-hour and a $1.00 minimum charge. The temporary ordinance was passed to give time for a valuation of the property of the company to be made by the state commission and upon this valuation will be based a ten-year rate contract. The Union Gas & Electric is the principal operating subsidiary of the Columbia Gas & Electric Company.

Electrical Development in the Bronx.

On January 31, 1914, the Bronx District of New York passed the 1,000,000 mark in 50-watt equivalents, making for this Borough a greater connected load than that of many of the big cities in the United States.

From 620 customers, and 38,771 50-watt equivalents in 1901, to 37,637 customers and 1,045,000 50-watt equivalents, seems like a long trail, but it has actually been covered by Edison service in the Bronx in 14 years. Startling changes are the custom in the Bronx, but the remarkable increase in the use of electricity is a story in itself. All this has come to pass since the year 1900, when The New York Edison Company succeeded the North River Light & Power Company in this district. In 1900 there were about 25 miles of street mains and at the present time there are 250 miles. In 1900 there were approximately 450 customers, using about 28,000 16-candlepower equivalents. The City lighting, which is included in this total, amounted to 800 street arc lamps. There were at that time 71 employees. The substation equipment consisted of a generating capacity of approximately 1,200 kilowatts and the output for the first year amounted to 3,000,000 kilowatt-hours.

In the year 1905 the population of the district amounted to about 271,500 with a connected load on the Edison lines of 1,290 customers, aggregating 110,087 50-watt equivalents. This was an increase of about 35 per cent for the population growth and of more than 290 per cent of electric consumers.

At the end of the next five year period, 1910, the population was estimated at 439,575, or a growth of 62 per cent, with 11,986 customers and 424,184 50-watt equivalents, or a net increase of 285 per cent.

On January 31, 1913, the estimated population of the Bronx district was 575,000, out of which there were 38,590 Edison customers, and a connected load of 1,045,000 50-watt equivalents. As remarkable as the increase in population in the Bronx has been it will be seen that the increase in the use of electricity has out-distanced the growth of population by 115 per cent for the period extending from 1910 to 1914.

The accompanying table will give an idea of the rise in the volume of the company's business in the Bronx borough from the year 1900 to the present date, as well as the per cent and horsepower gained. The latter is given merely to illustrate the increasing use of electric service for manufacturing purposes.

The records of the company show an average gain of one electric consumer to every 15 persons, an average installation of 27 50-watt equivalents per consumer, and nearly two 50-watt equivalents to each inhabitant. This record would be hard to duplicate by any city of the size and population of the Bronx borough. These figures include the street lighting equipment maintained for the City of New York, the total of which is 3,859 lamps, comprising 1,994 street arcs, four flaming arcs and 1,895 tungsten incandescents. Additional city street-lighting installations are being placed on the Edison circuit every day and streets being lighted which were heretofore not lighted or where only gas was used.

Illumination of Portion of Southern Boulevard.

The present facilities for generating electric current are very extensive and it may be interesting to know that the total output for the year 1913 amounted to 49,500,000 kilowatt-hours. This work is handled by one central office located at 362 East 149th Street and three substations located at 140th Street and Rider Avenue, Park Avenue and East 188th Street, and Whitlock and Garrison Avenues. These substations are so located as to simplify the question of operation and distribution. Underground zones have been established and pole lines removed wherever business has warranted. Such changes have already been made on Third, Westchester, Longwood, Prospect and Tremont Avenues. The main offices at 362 East 149th Street, house 158 employees, while the various substations throughout the district, including the superintendent's office at 140th Street and Rider Avenue, have a total of 498 employees, making for the district a grand total of 656 employees as compared with 71 in the year 1900. Attractive showrooms where all kinds of electrical and commercial household devices are demonstrated to the public are located at the main offices of the company in 149th Street.

Third Avenue Looking East from Melrose Avenue.

The exceptional growth of manufacturing in the Bronx is shown by the increased use of electric power. In the year 1902, the first which shows any use of electric power in the Bronx, there were 741 horsepower used, while in 1913 there were motors connected to the extent of 14,482 horsepower. Almost all of the new buildings in the Bronx are on Edison service and practically all of the apartment houses now in course of construction have contracted for electric light. A large part of the lighting load is made up of store-window lighting and street signs, many of the main thoroughfares in the Bronx resembling Broadway in brilliancy of illumination.

Year	Customers	Per Cent Gain	50-Watt Equivalents	Per Cent Gain	Power
1901	620	..	38,771	..	.....
1902	726	17	55,205	42	741
1903	824	12	65,787	19	941
1904	996	17	83,072	26	1,190
1905	1,290	29	110,087	32	1,680
1906	2,101	63	156,829	42	2,229
1907	3,240	54	212,534	35	3,106
1908	4,361	34	258,434	21	3,641
1909	6,782	55	309,120	19	4,549
1910	11,986	76	424,127	37	6,169
1911	20,146	68	579,175	36	7,651
1912	28,582	41	754,901	30	9,350
1913	37,637	31	998,389	32	14,482

Only approximately one-half of the Borough of the Bronx is supplied by the New York Edison Company, the remainder being the territory of the Westchester Lighting Company and the Bronx Gas & Electric Company. The possibilities of the industrial growth of the Bronx have only been fairly opened at the present time, the real future being still ahead. The Bronx is made up of more than 26,000 acres, the principal part of which is comparatively new territory, the developments so far having been confined almost exclusively to the lower half.

Electric Sign Data

Electric Sign Advertising in Boston.

An interesting commentary on the electric-sign situation in Boston, Mass., by G. H. Young, of the Edison Electric Illuminating Company, gives some of the reasons why greater progress has not been made in spectacular electric signs in that city. The chief reason is on account of the existing ordinance which unduly restricts the hanging of signs. Speaking of this, Mr. Young says that the question is repeatedly asked by Boston merchants, "Why are there so few spectacular signs in Boston, the kind of signs that have made Broadway and extended its blazing trail of commercial prosperity so many miles?"

A sign man in Boston, should he admit that there are fewer of these signs (per capita), would refer to his marked limitations. Among the restrictions on electrical advertising on a large scale, there is none more potent than the "two-foot rule" prohibiting the projecting of signs more than two feet from a building line, and setting a maximum of fifteen feet on the perpendicular length.

New York City permits electric signs to project eight feet beyond and over the building line, and in other cities, also, electrical advertisers of modern merchandise have had greater opportunities to produce results.

In Boston there has been an apparent dislike of the big spectacular sign—the sign that makes one buy. The flashing of names written electrically stamps them indelibly in the minds of the buying public.

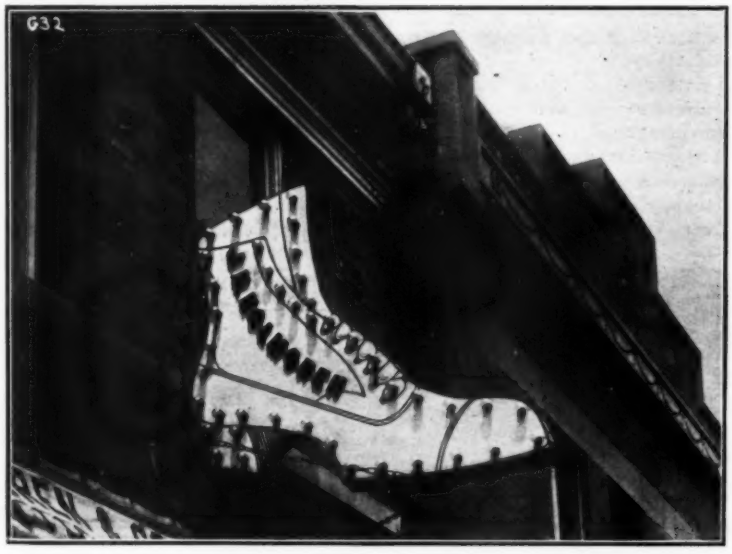
But although Boston has been reluctant to step aside, for reasons mentioned and no doubt also on account of geographic conditions in reference to arrangement of streets, the future success of the electric sign here is inevitable. The great Edison clock on Boylston Street, a leader of its kind, set the pace, and in the past two years electrical advertising has been assuming greater proportions; and new inquiries are coming in even from the conservative banks and churches. Only recently a prominent Boston banker expressed the opinion that the banks would soon wake up to the advantages of electrical advertising and follow the lead of western institutions of the same class.

The great value of electrical advertising as a business getter is unquestioned and the possibilities of the designer and manufacturer of electric signs is unlimited.

In connection with the Boston situation, L. D. Gibbs, advertising manager of the Edison Electric Illuminating Company, who has been co-operating with the contractors in Boston and showing them how to boom their own business as well as to help the central station, said that his department would try to furnish halftones for them for their illustrations, to a limited extent, until further notice.

"You can put up any sign," said Mr. Gibbs, "that with some definiteness calls attention to your business or to the electrical business, and wire back to a proper location, and we will install the meter and furnish the current for advertising purposes, you to take the responsibility of furnishing a time switch or seeing that the sign is turned off at proper hours. We advise and urge that you make it a point to burn these signs, for which we furnish the current, as many hours as it is at all profitable to do, from early evening until as late as there are people passing.

"We are also going to try to get around to each one of you with miniature house signs, in regular rotation, but expect you to furnish the lighting for them. You may wait for two months for one of these signs, but don't get worried, because you want to remember that we hope you will have a live proposition always with this house wiring plan. It has not been put out in a spectacular way, but as I understand it, it is one of the fundamental things that is going to make business for all of us."



Electric sign manufactured by the Federal Sign System (Electric), Chicago, Ill.

This sign is inexpensive yet is very effective for shoe stores. As will be noted, the shoe is outlined with lamps; the background is a blue enamel with the name of the merchant in black, raised letters.

There are 43 10-watt tungsten sign lamps used, burning continuously. A sign exactly the same as the one illustrated is arranged with a flasher that lights each lamp separately and the effect is very pleasing. The name can also be flashed if it is desired to do so.

No color effects are used except for the lamps.

Electrical Construction

WIRING AND EQUIPMENT FOR FORMING EDISON BATTERIES.

G. E. Ellis, Jr.

Recently in making an extensive addition to its factory, at West Orange, N. J., the Edison Storage Battery Company has provided a space for forming and testing cells about four times that previously occupied. One floor, nearly the entire length of the west wing of the new extension, is devoted exclusively to the forming of the smaller capacity types of cells for lighting, ignition, etc., while a portion of the south wing of the building on the same floor adjoining, about 225 feet in length, is devoted to the larger capacity types, such as are used for electric vehicles, street cars, train lighting, etc. The total floor space devoted entirely to testing is about 25,000 square feet.

The supply of direct current for the large number of battery circuits in this room is taken from two-phase, 60-cycle rotary converters which also supply power for the constant-speed, 115 and 230-volt direct-current motors throughout the main factory. The three-wire distribution system is employed, the neutral being brought out from the middle points of the secondary coils of a bank of single-phase transformers and run with the other two legs of the line taken from the direct-current side of the rotary, to the direct-current rotary panel and thence through automatic 3,000-ampere 250-volt overload circuit-breakers equipped with low-voltage release and reverse-current relays to the direct-current bus which supplies the current for the testing and power feeder circuits. Two 1,500-ampere, 120-240-volt feeder circuits supply the current for the testing and forming room. The three-wire feeder cables, the outside legs of which are 2,000,000 circular mils, and the neutral 1,000,000 circular mils, are taken from the switchboard trench in the substation on the first floor to the ceiling of the second floor (where the testing room is located) in rigid iron conduit bushed on the ends. Upon emerging from the conduit the cables are run under the concrete floor beams on a rack specially constructed of four-inch channel iron which is fastened up by means of seven-eighth-inch anchor bolts. To this are clamped the procelain cleat insulators by means of pieces of strap iron bolted to the channel iron. Two bolts pass through each strap, the insulator being held in between. When the nuts are tightened up on the strap iron the cable is gripped and held securely. See Fig. 1.

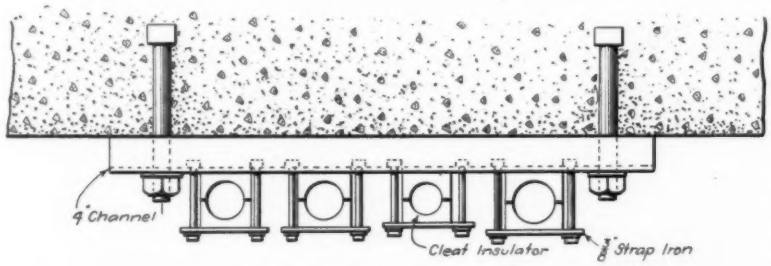


Fig. 1.—Method of Hanging Feeders.

The three-wire feeder cables having the longest run are tapered toward the end, the busses of the testing circuits being supplied at intervals directly from these mains. On the positive side of the three-wire feeders another or fourth leg is tied in, when the testing switchboards are reached, in order to add the voltage of a 60-volt shunt booster. The addition of this leg provides for charging as many as 140 to 150 cells (which are the standard numbers usually connected in circuit) the booster voltage being added toward the end of charge as the battery counter-electromotive-force rises. Also this enables trays containing a small number of cells to be charged very economically on the "booster" side of the line. The negative leg of this four-wire line is made about one and one-half times larger than the positive booster legs on account of the added current it has to carry. That is to say a great deal more current is carried to the negative by the addition of the booster leg, as a great deal of charging is done on 300 volts as well as on 240 volts. Separate panels are provided for the motor and the generator of this booster set, the motor circuit being taken directly off the 240-volt three-wire testing feeders. Fig. 2 shows the way this set is connected up to the feeder mains, showing protective devices, etc.

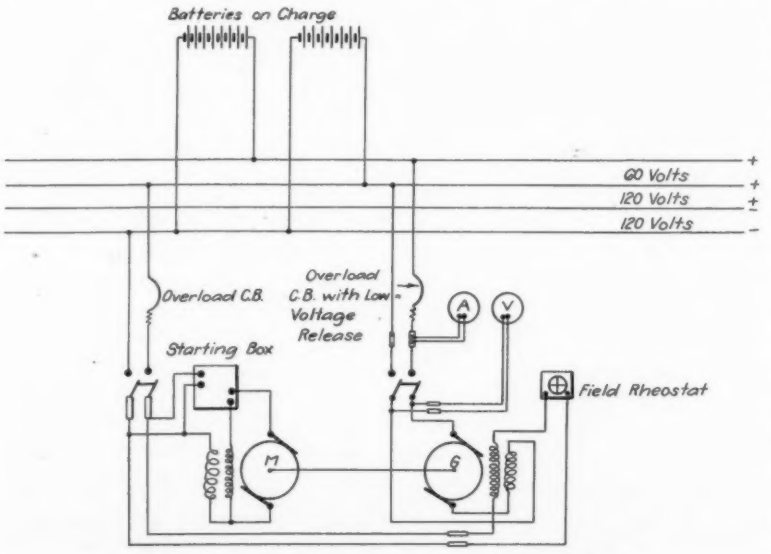


Fig. 2.—Diagram of Booster Set Connected to Feeders.

The testing switchboards in the west

wing, all of which have been added recently, are arranged on structural-steel galleries which run the full length of the room on either side. On these galleries groups of 10 panels are arranged in each bay, back to back, transversely in reference to the gallery. See Fig. 3. This permits the most economical spacing of the circuits and the operator in the gallery can more easily watch the batteries on the floor. This also allows of good ventilation as there is a natural draft across the room from the windows, the switchboard offering no obstruction in this position. The principal features of the switchboard arrangement are as follows:

(1) Individual panel for each circuit.

(2) Ammeter on each panel always in circuit so that the rate can be constantly watched.

(3) Close regulation of current secured by using a coarse and a fine interpolated adjustment of the variable rheostat (also a fixed resistance is used which can be added or subtracted by a short-circuiting switch).

(4) Voltages obtainable by means of two single-pole, double-throw switches and a triple-throw swivel switch.

(5) Balanced discharge into either side of 120-240-volt line or through resistance.

Fig. 4 gives a good idea of the general layout of the circuits, showing arrangement of switchboard on the gallery and the wiring to testing trucks below. Note the very compact arrangement of the rheostats, the fixed resistances being below. Fig. 5 shows the wiring connections for a single circuit. The usual method of operation on the first forming run for a standard circuit of 140 or 150 cells is to throw in on 120 volts for a few minutes, then step up to 240 volts by the swivel switch, remaining on this point for several hours, then finish the last three or four hours of charge on 300 volts by stepping up to the third position of the swivel switch. Subsequent charges are usually started directly on 240 volts, owing to the somewhat higher counter-electromotive-force of the cells to start. The discharge is first started by throwing in on the 120-volt position and discharging directly into either side of line; when the operator is unable to maintain the required constant discharge rate by discharging into line with all the resistance cut out, he throws open the lower single-pole, double-throw switch connecting with the positive side of the line, and cuts in some resistance; then throws the switch over to the reverse position and regulates the current to the correct rate. By this means the battery is discharged entirely through the resistances. The fixed resistance is used and made just half the value in ohms of the variable as it effects a saving in cost and the steps obtained; using one-half as variable gives as close a regulation as could be desired.

The single-conductor battery leads of No. 10 rubber-covered wire run from the back of the panels to the ceiling (only a question of two to three feet); thence they are run together in a rigid iron conduit along the ceiling to points above the respective circuits, where pipe taplet fittings with openings for

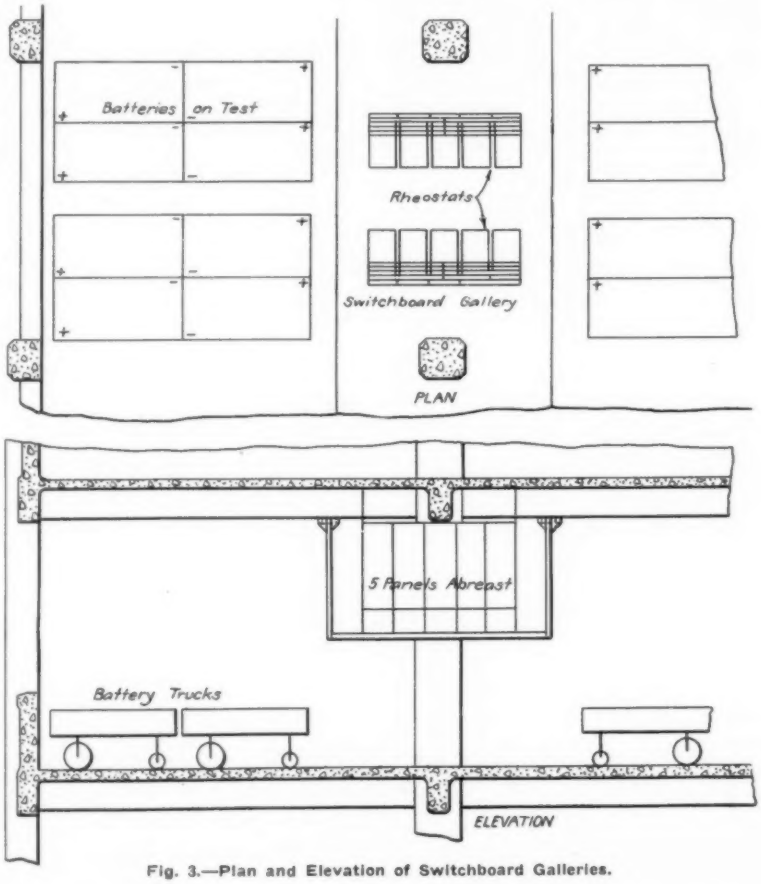


Fig. 3.—Plan and Elevation of Switchboard Galleries.

two and four-wire porcelain covers are provided for the drops to the battery terminals, the positive and the negative leads being kept separate so that there is no danger of leads of opposite polarity becoming mixed. The positive leads for the battery nearest the gallery, however, are run down through the flooring and along underneath, as this saves considerable wiring. See Fig. 4. The ends of the leads are provided with lugs which fit over the taper poles of the cells at the terminals of the battery and are clamped down with the terminal nuts, all contact parts being nicely reamed and finished to secure the best possible surface contact.

The circuits, as has heretofore been stated, consist usually of 140 to 150 cells, which are carried in wooden frames mounted on steel trucks, which greatly expedite the moving of the cells between departments. For the smallest size a complete circuit of 150 cells can be carried on one truck, 10 trucks being placed opposite the 10 panels in each bay. The bodies of these trucks have angle-irons running lengthwise on each side into which fits the wooden frame which is insulated from the steel work by flat pieces of porcelain. This frame supports the wooden blocks, which are placed crosswise, being long and narrow and raised at intervals and shaped to fit the bottoms of the steel cell containers. (See Fig. 4.) Across the top of the frame strips are nailed to keep the cells spaced equally and to prevent the cans from touching. As an additional precaution to guard against grounds, all wooden frames and blocks are dipped in the insulating paint manufactured by the company especially for the cell containers, trays, battery boxes, etc.

Voltage readings of each circuit are taken at intervals during each discharge, a regular form, giving a record of each run, being kept and showing actual capacity of each cell, which owing to the "watch-like" precision of manufacture show a remarkable uniformity. To obtain these voltage readings rapidly a low-reading, finely-di-

vided-scale voltmeter is employed having a period that will allow 30 or more full-scale deflections per minute. This meter is read by the operator in the gallery, one being fastened to a table in each bay.

The instrument leads run down to a forked wooden stick provided with soft copper strips on each tip to which the leads are clamped by a sort of binding screw and copper washer. With this stick the boy on the floor bridges the cell terminals, bringing down the stick with sufficient force to insure a good contact and obtains the voltage of each cell. In this way the readings for an entire circuit can be taken in about five minutes. After each discharge the cells are watered by means of a special electric filling device, which closes a circuit through a relay ringing a bell when the solution has reached the proper height above the plates.

The chief distinction in the larger capacity circuits in the south wing is that of course heavier wiring and copper is employed; also more space per circuit has to be allowed on the floor, making the arrangement of the panels different; otherwise the general layout of the circuits is the same as in the west wing. In addition, however, to the regular type of panels for charging and discharging, there are in the shipping room a few panels of different capacities for commercial charging only, the voltages obtained being 60, 120, 180, 240 and 300, whereby various numbers and sizes of cells can be accommodated. These panels either employ five receptacles for obtaining the different voltages or a combination of a single-pole, double-throw switch and a triple-pole swivel switch. Combined overload and underload circuit-breakers are placed in each of these circuits, most of this charging being done at night; consequently the rate is not apt to be so carefully watched as on the regular forming circuits.

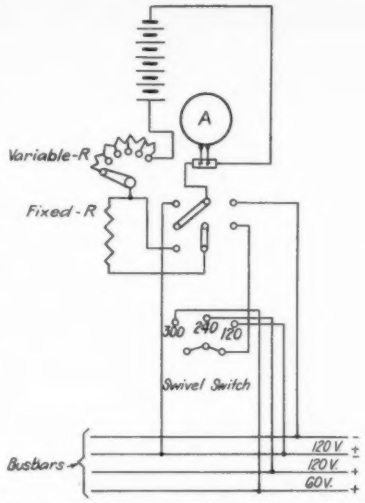


Fig. 5.—Wiring Connections for a Single Circuit.

As a whole, probably the most striking feature of this forming room, is the entire absence of all corrosive and suffocating fumes. All copper, polished nickel and other exposed metal parts are perfectly clean and bright. No special lacquers or protective coatings of any kind are employed as the gases given off from the alkaline solution of the Edison battery are odorless, colorless, and non-corrosive, the potash solution of itself being a preservative of steel.

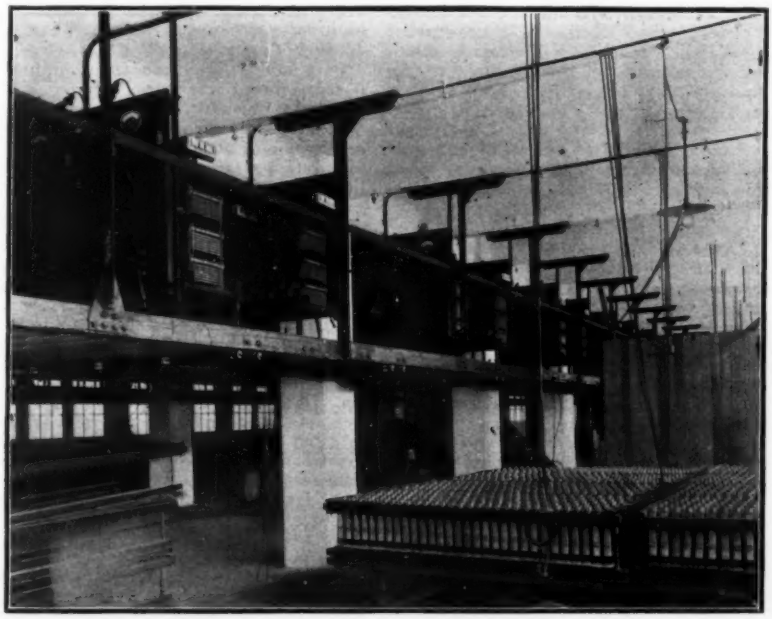


Fig. 4.—General Layout of Circuits, Showing Arrangement of Switchboard.

Tests on Weatherproof Insulation for 2,300-Volt Distribution Systems.

At the recent Cincinnati convention of the Western Association of Electrical Inspectors, as reported quite fully in our issue of February 7, there came up a report by the Committee on Outside Wiring. The main topic considered in this report was whether 2,300-volt distributing circuits should have bare or insulated wire. The report strongly recommended insulated wire. Supplementing the report was a very interesting paper by Edward J. McGann, of the division of electrical inspection, City of Chicago. Mr. McGann's paper gave the striking results of some original tests of weatherproof insulation for 2,300-volt lines and is therefore reproduced below in slightly condensed form.

From the standpoint of present practice the suggestion that 2,300-volt secondaries be run without insulation on the conductor itself, could be considered as a radical departure in this branch of electrical construction, if the suggestion were expressed as a reality. Again the suggestion was evidently made at a time when the ineffectiveness of weatherproof insulation at this voltage was taken into consideration, the assumption being that 2,300 volts on a weatherproof insulated wire was as dangerous a factor to life and property as the bare conductor itself.

The results of the tests herein contained are not to be taken as authoritative. They were made only to show the possible degree of safety weatherproof insulation affords under different weather conditions and also for a basis of a discussion of a much mooted question.

Extending our thoughts to the hazardous sphere of the line repairman, one need not stretch his imagination very far to consider his position on a wet day working on bare conductors carrying 2,300-volt current, or linemen stretching a new line of bare wire on a pole already having 2,300-volt bare lines strung thereon under any condition of weather.

Weatherproof insulation, although not guaranteed to withstand undue strains, at least offers a certain protection to linemen when elevated on tower wagons or on poles with spurs. As a comparison common lamp cord with only one-thirty-second inch wall of rubber insulation must withstand 6,000 volts on a breakdown test. The thickness of the wall of new weatherproof line wire No. 8 to No. 2 is from three sixty-fourths inch to one-sixteenth inch, which is double that of the rubber wall of the cord and I dare say this insulation might stand 2,300 volts to ground without rupture, providing the line has not deteriorated too much from age.

Insulation Tests.

A number of test pieces of weatherproof insulated wire, which had been in the service of the Commonwealth Edison Company, of Chicago, show the following wet and dry insulation breakdown tests.

Size of Wire	Test	Length of Service (approx.)	Volts between Insulated Conductors ("cross")	Volts to Ground
				9,700 (a)
No. 6	Dry	New	15,000	9,800 (b)
				6,950 (a)
No. 8	Dry	New	10,000	8,200 (b)
			9,400 (a)	4,450 (a)
No. 6	Dry	3 years	9,500 (b)	5,250 (b)
			7,200 (a)	4,150 (a)
No. 8	Dry	5 years	7,700 (b)	5,750 (b)
			3,250 (a)	2,750 (a)
No. 6	Dry	10 years	4,050 (b)	2,400 (b)
				2,500 (a)
No. 6	Wet	New	4,375	2,500 (b)
				2,975 (a)
No. 8	Wet	New	5,350	3,250 (b)
			3,500	1,775 (a)
No. 6	Wet	3 years	3,350	2,225 (b)
			3,000	1,450 (a)
No. 8	Wet	5 years	3,750	1,900 (b)
			2,250	500 (a)
No. 6	Wet	10 years	2,000	750 (b)

Each sample was cut in half, for the tests under column "Volts between Insulated Conductors" designated (a) and (b), the test noted (b) being a check on the (a) test, on the 3, 5 and 10-year samples. Each test was made by hanging one insulated wire over the other and testing between conductors until breakdown resulted. Column, "Volts to Ground," also has an (a) and (b) test for each specimen, both of which were used for the "cross" test, the "ground" test being made at a different point on the insulation.

Each sample for the wet test was paraffined at the ends to prevent surface leakage and was immersed 24 hours in water. The idea of this length of immersion was to let the insulation absorb the same degree of moisture it might obtain by being exposed to a 24-hour rain beating down on the line. The tests show mathematical inconsistency due probably to ununiformity in manufacture or impurities in the impregnating solution.

The following table shows the relative thickness of insulation of the different specimens under test.

Size.	Age.	Diam. over Insulation.	Diam. of Conductor.	Thickness of Insulation.
No. 6	new	0.331 inch	0.160 inch	0.085 inch
No. 8	new	0.290 inch	0.128 inch	0.081 inch
No. 8	3 yrs.	0.292 inch	0.128 inch	0.082 inch
No. 6	5 yrs.	0.326 inch	0.160 inch	0.083 inch
No. 6	10 yrs.	0.224 inch	0.160 inch	0.032 inch

Test Comment.

I noted that the 10-year specimen was covered with only a single braid instead of a triple braid, as is now manufactured on this wire; the braid was badly worn and parts of the line from which it was cut were bare. The thickness of the insulation on this wire was only 0.032 inch while that of our present new wire averages 0.086 inch. This old insulation only stood a breakdown test of from 500 to 750 volts after 24 hours immersion in water. A lineman working on such a line surely needs all the protection afforded by rubber gloves tested at 10,000 volts.

Consider now the 5-year sample, the insulation was triple braid and measured 0.083 inch in thickness. After 24-hour immersion the insulation broke down at from 1,450 to 1,900 volts, showing that during this period of service weatherproof lines have had a great deal of the impregnated moisture-repellant washed out, and the line from a protective standpoint shows need of renewal.

The three-year sample also shows washout to an appreciable degree, the insulation breaking down at 2,300 volts for a thickness of 0.082 inch.

New wire under the same conditions of test broke down at from 2,500 to 3,250 volts. This insulation seems to be the only one to stand over 2,300 volts to ground without rupture.

Under dry conditions, the 10-year sample with the 0.032 inch thickness of insulation stood a breakdown-to-ground test of from 2,400 to 2,750 volts. This line with even this poor insulation might almost be handled with bare hands in dry weather, were it not for the attendant danger of standing on pole steps or spurs, which may penetrate into the pole sap. From the five-year piece to the new one the dry insulation test increases from 4,150 to 9,800 volts breakdown to ground.

Line Crosses.

To the initiated, no explanation of the amount of trouble that might be caused by a swinging cross on a line of bare conductors is necessary. To enumerate a few of these, I may mention: line flashes due to momentary contact between wires of opposite phases; transformer-secondary burnouts due to a possible welding of this swinging cross across wires of a phase; the frequent blowing out of fuses or circuit-breakers, if a generator is directly supplying these lines; heavy line surges due to these short-circuits.

After the above consideration of bare conductor lines permit me to again refer to the table showing the results of "Cross" tests between insulated conductors. The 10-year specimen previously considered shows a breakdown of from 2,000 to 2,250 volts between insulated conductors. With this low grade of insulation, 2,300-volt lines may experience trouble from swinging crosses in wet weather; a complete breakdown, however, might be stayed on account of surface leakage causing heating at the point of contact of the crossed lines, this heating resulting in a drying out of the insulation thus materially increasing the breakdown voltage above 2,300. Lines five years and less in service under wet-weather conditions would invariably stand 2,300-volt weatherproof insulated wires crossed on each other, as the range from the five-year to the new specimen varies from 3,000 to 5,350 volts breakdown. This test, if given any credence at all, shows that lines up to at least five years of age could be depended upon not to cause trouble between 2,300-volt conductors from line crosses as the breakdown test is necessarily too high.

Consider for a moment the effect of 10-year-old line carrying 2,300 volts, breaking and falling across a low-potential building service of the same age and insulation in wet weather. The effect is a short-circuited low-potential secondary and also the entrance of 2,300 volts into the building over its service wires, the latter probably causing disastrous results to apparatus connected to this service and to the lives of those having to come in contact with such apparatus. This same effect would exist if the 2,300-volt lines were run bare, and "crossed" on a building service 10 years of age, but in this case only a single wall of insulation would have to be broken down. Since this defective insulation broke down on a ground test at from 500 to 750 volts which is similar to the above conditions, it is clearly seen that by having both high and low-tension wires insulated the ratio of safety is 4 to 1 in favor of insulating both, to guard against high-voltage entrance into buildings. The "cross" test between insulated wires of this age varied from 2,000 to 2,250 volts breakdown.

Insulated building services of new wire would not be safe from high-voltage entrance with 2,300-volt transmission lines running uninsulated, the ground test showing only 2,500 volts on a "wet" test.

A piece of new telephone wire (new Code) tested, when dry, 10,000 volts to ground. A "cross" test between dry telephone wire and the 10-year, 24-hour immersed sample of weatherproof wire previously mentioned showed a breakdown test of 17,000 volts. If both pieces had been immersed for the same length of time, breakdown might have resulted at about 10,000 volts. Telephone systems would thus be removed from danger whether 2,300-volt lines were run either bare or insulated until both became deteriorated from age.

One advantage of weatherproof insulated lines, regardless of its insulation qualifications, is the protection it offers to copper wires in smoky sections of cities, particularly railroad yards. Bare lines in these locations, where wires are subject to sulphur fumes from smoke, would readily sulphate and after a year or two of service break down through this destructive agent. Public-service companies are not prone to spending money unnecessarily every few years for new copper lines when the insulation may be employed to this advantage.

Summary.

In consideration of the life and fire hazard from 2,300-volt entrance into buildings in conjunction with the results of the wet "cross" and "ground" tests it is apparent that bare conductors would most certainly increase these hazards when crossed on an old building service. The insulation breakdown on the wet "cross" test shows up so high even with 10-year old single-braid insulation that the possibility of high-voltage entrance into buildings causing destruction to life and property would be reduced to a minimum if triple braid were used and aged for the same period.

New weatherproof wires under wet conditions of weather are the only ones standing a strain over 2,300 volts. Since lines must necessarily age after being put into service, it is a fact that after a year or two on the pole the insulative quality of the insulation becomes almost useless from the standpoint of a protection to linemen. In general, linemen and repairmen who have no ready access to data concerning the age of pole lines can only judge their age from long experience, and the policy of safety of using rubber gloves on *all* lines of this voltage offsets the deficiencies of insulation. As previously cited elsewhere in this report, weatherproof insulation is also a protection against the elements. This protection is a decided advantage over bare conductors.

Although the advantages of insulating the wires over the use of bare conductors are decidedly in favor of insulation, we cannot help but consider weatherproof insulation as a poor one. It seems that some years ago when

2,300 volts became an almost universal distributing voltage to transformers a cheap insulation was put on these wires, first because they were out of reach on poles away from any danger of being handled except by the operating company's repairmen and secondly because the wires gave an appearance of safety to the unsophisticated public by being insulated.

The only reason that this old insulation is used is because of its cheapness. No improvement in this particular branch of electrical construction has been achieved.

I say improve the insulation on these wires to give the protection desired against this voltage. You may argue that an improved insulation means dearer line construction; lives also are dear, so is electrical apparatus. Let us have a better insulation so that the destruction of these two vitals of the electrical industry may be practically eliminated.

A Singular Electrical Fire.

There have been reports of all kinds of "freak" fires caused or supposed to have been caused by electric wiring, but the following account is worthy of mention as it is the first one of its kind brought to the writer's attention.

A call came recently from one of our customers that the dining-room floor push in one of the residences, had caused a fire and wondering all the time I was on the way what this mysterious message meant, found on reaching the premises that the dining-room floor push was an old-style arrangement with the plate split through the center. The customer was having his floor refinished and the painter had the floor covered with wood alcohol to remove the old varnish, using steel wool for rubbing. There were four dry cells on the dining-room bell, which happened to be connected to an annunciator. It did not take much of a spark to ignite the wood alcohol and the entire room was filled with flame. The contact was made by rubbing the steel wool over the plate of the floor push and this made the spark.

E. M. Raetz.

Signaling From Meter Station.

The peak load on our system is in excess of the capacity of the power house, which is 5,000 kilowatts. We are, consequently, compelled to purchase power from another company at certain times. This is accomplished by tapping the high-tension transmission line running from our power house to the substation, 90 miles away. At this tap, which is 30 miles from the power house, connection is made to the generating station, which is connected in parallel through meters which are provided with reverse cutouts so that the meters will not run backwards in case current flows from the line into the auxiliary power house. It was known that at times power was being transferred in this direction, however, and it was desired to control this without keeping an operator on duty at the auxiliary station. It was accomplished as follows:

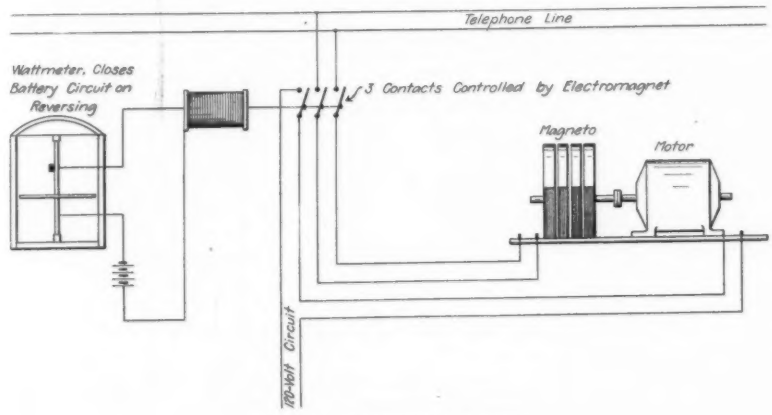


Diagram of Signaling System.

A telephone line was utilized, as shown in the accompanying illustration. When current flows into the station so as to actuate the meter cutout it also closes a local battery circuit and causes an electromagnet to close three contacts simultaneously. One of these is connected in the 120-volt driving circuit of a motor which brings a magneto up to speed. The other contacts connect the magneto to the telephone line, thus ringing a bell at the main power house. The operator here then reduces his voltage until the bell stops ringing. The device does not interfere with the use of the telephone line in any way.

By occasionally bringing the voltage up until the bell rings and then reducing it again until the bell stops ringing, the operator can at all times be sure that power is not supplied in the wrong direction and yet keep his voltage up to near equality.

An adjustable spring on the shaft of the meter allows a small amount of power to flow back before the mechanism operates. This avoids too delicate a balance.

James McMahon.

Meeting of Oregon Contractors.

The annual meeting of the Oregon Electrical Contractors' Association will be held at Portland, Ore., on June 8 and 9. This will be during the week of the annual Rose Festival, and it is expected that a large attendance will be a feature of the meeting. Particular attention is to be paid to manufacturers' exhibits, for which special facilities, with free space, will be provided.

Among the Contractors.

The Wagner-Woodruff Company, of Los Angeles, Cal., was awarded the contract for placing electric fixtures in the Board of Education's warehouse on San Pedro Street.

The contract for the electrical wiring of the Lehr Memorial Building, Elyria, Ohio, has been let to Avery-Loeb Electric Company, of Columbus, O.

The Marine Electric Company, of Louisville, Ky., has the contract for wiring the courthouse at Shelbyville, Ky.

The Santa Monica Supply Company, which is now under the management of William Atwell, Jr., and J. S. Lockwood, has recently moved into new and larger quarters at 1446 Third Street, Santa Monica, Cal. The company manufactures fixtures and deals in supplies, besides doing a general electrical contracting business.

The General Electric Inspection Company, Newark, N. J., has been awarded the contract for electrical work and wiring in the new temple and school building for the Congregation B'nai Jeshurun. About 800 lamps and small motors totaling about 50 horsepower, will be installed.

The contract for the electrical installation for the new Broadway Theater in Portland, Ore., has been awarded to the West Coast Engineering Company. The electrical equipment of this theater will be very complete, especially for the stage and special lighting effects. The lighting of the exterior of the building and the main entrance will be among the interesting features, and will consist of approximately 600 decorative lamps. The company also has orders to overhaul the electric wiring system in the Portland Academy.

The Swan-Bower Company has been incorporated to engage in the business of electric wiring and handling fixtures and supplies at Steubenville, O.

Dollar Wiring Kinks.

Every reader is invited to contribute to this column. It does not matter how few words are used to explain a "Dollar Wiring Kink," provided the idea is made clear; and if a diagram is necessary, a rough pencil drawing will serve. The idea itself must, of course, be new and bright. A dollar will be sent to the contributor upon publication.

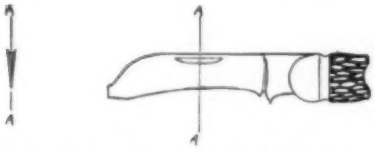
Skinning Wires.

Anyone who has a number of fixtures to make up will find that by making a notch in his knife blade, as shown in the illustration, he can strip the ends of the fixture wire in about one-quarter the time otherwise required and not run the risk of breaking the wire off, as is often the case when a sharp blade is used. Simply insert the wire in the notch and pull the knife along it. John Shortt.

Notched Knife Blade.

Another Way.

When using a pocket knife to strip insulation from wires it is impossible to keep the blade sharp for any length of time. I have found it desirable to grind the back of the blade hollow, as shown in the accompanying illustration. This is done on an emery wheel, leaving two sharp edges at the section through *AA*. These edges are used for skinning the wire after they have been stripped with the cutting edge.



Knife Blade with Ground Back and Screwdriver Point.

Another handy attachment on a knife blade is a screwdriver for light work, such as connecting sockets. It is formed by grinding down the point of the blade to the desired shape, as is also shown in the illustration.

Robert Oster.

Dimming the Light.

A novel arrangement for turning down an electric light in places where the lamp is within reach is the following: In a dome over the dining-room table I use a single pendent tungsten lamp with a glass reflector. I took the strings off of a "dimalite" socket rheostat which I used for the purpose and by using a weatherproof-socket shade-holder was able to attach the reflector directly to the dimalite. An ordinary shade-holder was too small. Mounted in this way the light can be dimmed or raised to full brightness at will by turning the reflector. H. Piccard.

Threading Tube Without Scratching.

In threading one-eighth-inch brass tubing, such as is used in fixture work for arms, stems, etc., take a 12-inch round file and turn it into the opposite end of the nipple to be threaded. By placing the stocks in a vice, the tubing can be turned by applying a pipe wrench to the file, thus leaving the finished surface of the tubing unharmed.

W. C. Dee.

Rolling Hitch.

There are many times when it is desired to pull up a line of wire without the aid of a come-along, Buffalo or other form of wire grip. In such a case the rolling hitch which is illustrated in the accompanying figure is very useful. The rope or cord should be arranged to form the hitch as shown, and care must be taken that all of the turns are pulled up tight before the strain is applied, for in this lies the holding power of the hitch. To increase the gripping capacity of the knot, half hitches can be made at the strain end of the object, but these are not really needed unless the strain that is to be applied is terrific or the object is very small in diameter, such as a No. 9 iron wire. It may be noted that this hitch will hold fast on a length of two-inch steel shafting, even though smeared with grease, provided all turns are made close and pulled tight and several half hitches taken in addition. W. E. Rhodes.

The Rolling Hitch.

Fishing in Partitions.

In the issue of February 14 there is a wiring kink by William E. Rhodes on "Fishing in Partitions." He uses a string with pieces of lead attached. I have found a much better scheme is to use a piece of chain such as plumbers supply for bath-tub drains. The chain is flexible and strong, so that it is not likely to break, and will not hang up on the plastering or nails. It can be used to pull wires through flexduct, as well as partitions. I carry a piece of the chain in my kit at all times.

A. H. Jackson.

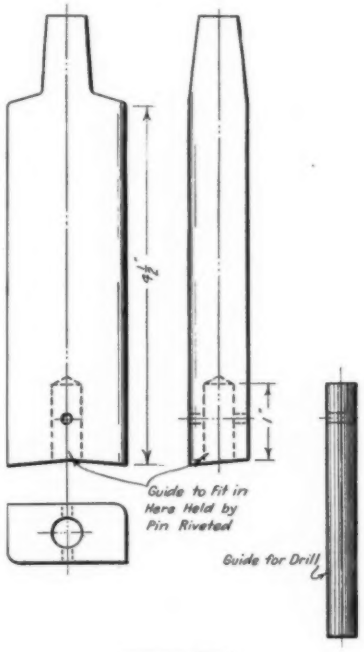
Tight Socket Bushings.

I have found that some socket bushings are very hard to screw into the socket and are often broken in the attempt to do so. I find that this can be prevented by heating them a little, after which the bushing can be easily inserted and breakage avoided.

A. J. Smith.

Tool for Drilling Marble.

A tool for drilling large holes, say 1.5 inches in diameter, in slate and marble is shown in the accompanying illustration. It is made of tool steel 1.5 by 0.75 inches. Larger or smaller drills can be made by choosing stock of the proper dimensions. The drill should have a hole in the bottom about one inch deep, exactly in the center. This is to be used for a guide, the guide rod being made of a three-eighths-inch steel rod, which is held in position by a pin riveted through the drill. The length of the guide rod depends upon the thickness of the panels to be drilled and will generally be about two inches.



Drilling Tool.

This drill will be found very useful where both speed and accuracy are desired. A three-eighths-inch pilot hole is first drilled through and the guide of the large drill is inserted in this. The guide holds the drill in definite position and prevents creeping and side play. It will be found of great benefit for drilling holes in old panels where the new holes are directly alongside of or cut partly through the old ones. The guide thus prevents the drill from shifting over into the old holes. H. W. Parsons.

Public Service Commissions

CALIFORNIA.

Pacific Gas & Electric Company. The Commission, in its own motion, has instituted an investigation of the rates, service and extensions of the Pacific Company in its San Jose district.

Southwestern Home Telephone Company. The Commission rendered a decision upon this Company's application for authority to issue $101,300 in short term notes and to pledge $197,000 in bonds as collateral security therefor. The Commission does not make a final ruling in the case, but states that it will hold the matter in abeyance until July 1, 1914. It directs the company to take steps to reduce its floating and bonded indebtedness. The Commission also calls upon the company to arrange to cancel $300,000 in stock which was issued originally on a contract by which the company had the right to retire it upon the payment of $3,750.00.

The Oceanside Electric & Gas Company has been granted authority by the Railroad Commission to renew notes in the sum of $12,442, and to issue its six-per-cent twenty-year bonds in the sum of $25,000, a sufficient number of which will be sold by the Company at ninety per cent of the par value so as to net the applicant $14,100, which sum will be applied to the payments of the notes and to reimburse the treasury for additions and betterment.

The City of Claremont, Los Angeles County, has transferred the jurisdiction over its public utilities to the Railroad Commission.

CONNECTICUT.

Rules for Protection of Linemen. The Commission called a conference on the matter of the adoption of rules for the protection of linemen employed by trolley, telegraph, telephone and electric companies. The committee appointed by the interested companies, at the suggestion of the Commission, submitted a set of rules to be observed by the employees when at work. The rules were approved by the Commission.

GEORGIA.

The Georgia Railway & Electric Company was authorized to issue $334,000 in refunding bonds to be used to refund to the company a portion of the money expended for improvements and extensions during the last six months of 1913.

INDIANA.

The Indianapolis Telephone Company has been authorized to install an improved four-party line service at a reduced rate of $15 per year. The Central Union Telephone Company has applied for authority to increase its rates in Indianapolis and for the establishment of the measured service system of rates.

Electric Rates in Richmond. The city of Richmond which operates a municipal electric light plant, and the Richmond Light, Heat and Power Company have filed a joint petition asking for authority to reduce and equalize rates for electric light and power.

Natural Gas Case. The Commission has reduced the rate for natural gas in Union City and Winchester, Indiana. In determining rates the Commission made an allowance for depreciation, taking into consideration the average life of the well in each particular field. This is the first rate case handed down by this commission.

MARYLAND.

Municipal Utilities. The question of extending the jurisdiction of the Public Service Commission is being discussed by the Commission and a bill will undoubtedly be prepared by the general counsel to be submitted to the present legislature. Charles E. Phelps, chief engineer of the Commission, submitted a report to the Commission recommending that municipally owned utilities should be subject to the same regulation as privately owned utilities. The greatest evil of municipal ownership, says Mr. Phelps, is unfair and unprofitable discrimination in rates. The temptation to absorb the expenses of operation in the tax rate is also great. It is said that the conduct of some of the municipally owned gas and electric companies of the state is such as to convince the Commission that prompt and drastic action is necessary. Poor service, grossly discriminatory rates, often for political reasons; loose methods of bookkeeping and inefficient and careless operation are said to characterize the conduct of certain of the companies. If these companies are required to maintain the same standard of service, both as to quality and rates, that is required of privately owned gas and electric companies, it is contended, the public will be greatly benefited.

The Chesapeake and Potomac Telephone Company was ordered to reduce its telephone toll rates for Frederick County upon the complaint of the Frederick County Farmers' Association. The reduced rates are to be in effect April 1.

MASSACHUSETTS.

Proposed Legislation. The Supreme Court annulled the decision of the Board of Gas and Electric Light Commissioners in which the Board dismissed the application of the Fall River Gas Works Company for authority to issue stock. The annulling of this decision has called in question the authority of the Board over security issues. The Board has submitted a bill to the legislature which aims to more clearly define its authority over such issues. The bill provides that "the Board may refuse to approve of the issue of stock or bonds if in its opinion such issue would be inconsistent with the public interests." Forrest E. Barker, chairman of the Board, stated that the bill proposes no new principle. The policy that the Board must determine that stock issues by companies under its jurisdiction are reasonably necessary has been unchallenged for more than twenty years.

Public Service Commission. A bill to reduce the membership of the Public Service Commission and to provide for the election of the Commissioners is being considered in the legislature.

MISSOURI.

Springfield Gas and Electric Company. The final arguments before the Public Service Commission were heard in the Springfield lighting rates case. This is the first important valuation and rate case before this commission and a decision in this case will establish precedents for subsequent rate investigation. The franchise granted the company provided that not more than

15 cents per kilowatt-hour shall be charged for electric service. The general maximum rate for residence lighting charged by the company is 13.5 cents per kilowatt-hour. The city council passed a rate of 6 cents per kilowatt-hour and the company did not accept this rate, but appealed to the Commission to fix just and reasonable rates.

NEW YORK.

New York Telephone Company. The Assembly adopted a resolution asking the Public Service Commission, Second District, to explain lack of progress in the examination into the affairs of the New York Telephone Company.

The Commission of the First District Fails to Agree in regard to authorizing security issues of the Consolidated Gas Company, and the New York Edison Company. Commissioner Maltbie has filed an opinion opposing the applications in their present form. Commissioner Cram is also opposed to the issue while Commissioners Williams and McCall are in favor of granting all that the companies ask. It is alleged by the commissioners opposing the application that the expense vouchers have not been carefully examined to determine whether the expenditures are proper capital charges, and Commissioner Maltbie considers the 5.5 per cent rate of interest both excessive and unnecessary.

Assistant Secretary. Matthew J. Harrington of Manhattan has been appointed assistant secretary at a salary of $3,600 per annum to fill the vacancy caused by the resignation of William L. Ransom, now judge of the City Court. Mr. Harrington was formerly secretary of the Department of Docks and Ferries.

OHIO.

Bucyrus Light & Power Company. Milo R. Maltbie, member of the New York Public Service Commission, First District, was called as principal witness in the Bucyrus rate case before the Ohio Public Service Commission. This is the first instance in which a commissioner of one state has testified in a hearing before the commission of another state.

PENNSYLVANIA.

George P. Wilson was appointed chief of the bureau of tariffs by the Public Service Commission.

Utility Rates. An order is to be issued by the Commission requiring utilities to file all rates and schedules with the Commission.

WISCONSIN.

Appeal to Circuit Court. Test cases have been brought by the Milwaukee Northern Railway Company and the Chicago and Milwaukee Electric Railway Company appealing from the orders of the Railroad Commission requiring the joint use of certain portions of their respective systems by the Milwaukee Electric Railway and Light Company. It is alleged that public convenience does not require the joint use of tracks and that the Commission's order will have the effect of depriving the complainants of their properties without due process of law and without adequate compensation. The Circuit Court has been asked to set aside the Commission's orders.

The Chippewa Valley Railway Light and Power Company has been authorized to purchase the Ellsworth Heat, Light and Power Company and to issue $42,000 in preferred stock and negotiable funds to be applied on the purchase.

The Strum Telephone Company was authorized to issue $880 worth of capital stock, to be divided in shares of $40 each. Application was also made by the Company to issue $200 of additional capital stock to be used in payment for certain property heretofore acquired by it. The application was granted.

The Readfield and Fremont Telephone Companies were ordered to make a physical connection of their lines between Fremont and Readfield, the compensation to be fixed for each message was 10 cents, with a monthly charge of 25 cents for unlimited service over the lines of the above companies.

Oakfield Telephone Company. The company's application to increase its toll message rate to subscribers from Oakfield to Fond du Lac was denied. The company wished to charge 10 cents per message for messages of five minutes or less, whereas a charge of 5 cents per message had been in effect previously.

Philadelphia Section Activities.

The Philadelphia Electric Company Section of the National Electric Light Association is maintaining a high standard in the personnel of the speakers at its monthly meetings. On Monday, February 16, the speaker was John Price Jackson, dean of the Engineering School of Pennsylvania State College. His topic was "Co-Operation and Effectiveness in Industrial Organizations." Professor Jackson's discourse was greatly appreciated, not only because of its high intellectual character, but also because of the note of sympathy which was produced by the fact that the speaker was many years ago attached to The Philadelphia Electric Company. Professor Jackson is commissioner of the Department of Labor and Industry of the State of Pennsylvania, and has had charge of a recent conference under whose auspices labor organizations and employers were brought to a better understanding. The speaker stated that effectiveness in industrial corporations was dependent upon two things. The first was the right attitude on the part of the employees towards the company, and the other was a due appreciation on the part of the company of the services of its employees. Employees should not indulge in criticism of the company among themselves, much less to outsiders, who would undoutedly take a very wrong meaning from caustic adverse remarks. Employers should remember that their workmen are human and that appreciation of their services, and improvements which tend toward their safety and sanitary and pleasant working conditions, would do more towards bringing about an effective organization than caustic criticism or arrogant methods. The speaker related many instances illustrative of these points which both amused and interested his audience. Professor Jackson's discourse should go far toward promoting the co-operation and effectiveness which was the subject of his paper.

The meeting of the Engineering Department Branch on February 2, was a "Beacon Night." The speakers of the evening were Albert R. Granger, manager of the Beacon Light Company, Chester, Pa., and John E. Melloy, electrical superintendent of the same company. Mr. Granger's remarks were of a historical character and brought out many incidents in connection with the history of the earlier days of the company, which brought memories of the olden days to the minds of many of his hearers. Mr. Melloy ably supplemented Manager Granger in his remarks concerning the mechanical operation of the Beacon Company.

The February meeting of the Meter Department Branch was held on February 6. The paper of the evening was entitled "Economic Factors in Central Station Development" and was prepared and read by A. R. Cordner, of the Philadelphia Electric Company's Meter Department. This paper is one of those submitted in the Joseph B. McCall prize competition. Mr. Cordner's paper showed that he had given his subject much study and thought and that it will stand well among the papers which will receive foremost consideration.

Philadelphia is mindful of the fact that it is to be honored with the 1914 convention. Wide-awake committees have been appointed to look after many of the things which will need to be cared for in such a large gathering, and all those who attend the convention will be assured of plenty of good old Quaker hospitality.

Questions and Answers.

All readers of the Electrical Review and Western Electrician are invited to submit questions and answers to this department. Full names will not be printed except where the writer indicates his willingness therefor. Anonymous communications will not be considered. Questions relating to electrical matters of any kind will be inserted. Answers from our readers should be received in this office preferably within ten days of the date of publication of the question, and will be published in a subsequent issue. Payment will be made for all answers published.

Questions.

No. 200. — ELECTRICALLY OPERATED PHONOGRAPH.—Is any phonograph on the market in which winding of the spring is automatically done by a silent electric motor whenever the spring tension gets down to a certain point? I believe several patents have been issued on electromagnetic release for a brake that stops the disk when the record has been played; has any device of this kind been applied to any phonograph on the market?—M. P. C., Jackson, Mich.

No. 204. HIGHEST VOLTAGE.—What is the highest known voltage ever developed in any electrical apparatus?—M. L., Oak Park, Ill.

No. 205.—LAMPS FOR BLUE-PRINTING MACHINES.—What kind of lamps are best to use for blue-printing machines, carbon arc lamps or mercury-vapor lamps?—H. I. N., St. Louis, Mo.

No. 206.—SHORT-CIRCUIT CURRENT.—If a short-circuit, consisting of a No. 4 copper wire, should occur across a 600-volt railway feeder of approximately 871,000 circular units at a distance of 70,000 feet from a power plant which is the source of the current, what current would flow through the feeder and what would be the voltage at the source of supply, and how is it calculated? The power plant has a full-load capacity of 600 kilowatts with an overload capacity of 50 per cent of the full-load capacity.—J. G. M., La Marque, Tex.

No. 207.—CONNECTION OF CURRENT TRANSFORMERS.—On an alternating-current, three-phase 2,200-volt switchboard with indicating wattmeter that has two potential and two current transformers, (A) does it make any difference in the reading of the wattmeter, if both the secondaries of the current transformers are reversed on their own transformers? If so, why? (B) Does reversing the secondaries of one current transformer change the wattmeter reading? If so, why?—T. J. O. K., Atlanta, Ga.

No. 208.—MOTOR TROUBLE.—I have a 40-kilowatt machine which was formerly run without trouble as a generator; now it is used as a motor, and on starting or stopping a heavy flushing occurs around the commutator, although the motor runs fine on full speed. What is the cause of this?—J. M., Kearney, N. J.

No. 209.—SERIES-PARALLEL LAMP CONTROL.—How can I arrange a circuit to throw three lamps from a parallel to series connection and vice versa? Can this be done with only one switch?—B. T. O., Chicago, Ill.

Answers.

No. 196.—SPEEDING UP STREET CARS.—If an electric street car designed for a maximum speed of 25 to 30 miles per hour is to be run part way in a rapid-transit subway at a speed of 40 to 45 miles per hour, can the motor and control equipment be readily adapted to the higher speed desired or must a motor equipment designed for the higher speed be substituted? Could this be accomplished satisfactorily by changing the ratio of the reduction gear?—B. F., Chicago, Ill.

The best suggestion that can be made on this is to use the old method of shunting a portion of the motor fields in order to obtain the higher speed, provided that the design of the motors will allow of this without sparking and also provided that the higher speed does not require greater power than the motors are capable of. The changing of pinions, etc., as suggested by others, has the disadvantage of giving the higher speed at all times and I would assume from the question that the old conditions of the outside running were to be maintained in addition to the subway work and it is likely that conditions would not warrant the higher speed outside.—W. M. P., Seattle, Wash.

No. 201.—FIXTURE WIRE.—Is heavier wire than standard fixture wire required in fixture work in any city? I have been told that this would soon be required in all large cities because of the tendency to connect flatirons and other appliances to the nearest fixture outlet. Is there any basis for this belief?—S. W., Chicago, Ill.

While electric irons are not supposed to be connected to electric fixtures or cord drops, this is the most common method of using them. The general use of electric irons and other electric devices has developed much faster than the wiring of buildings. The large majority of buildings are being wired under specifications that were in use ten years ago. The architects and owners have not been educated to the present-day requirements, consequently no provisions are made for the many electrical devices which are in common use. Base, wall and floor receptacles should be provided, when the building is being wired, for the use of electric irons, coffee percolators, hot plates, radiators, vacuum cleaners, washing machines, etc. The National Electrical Code would hardly sanction connecting irons, etc., to fixtures due to the fact that the connected load would then exceed 660 watts. The six-pound iron which is the size mostly commonly used is rated at 550 watts and with the addition of the lights the wattage may be well over the Code limit.

The writer has in a number of instances designed the fixture with a Hubbell chandelier plug No. 5325 or similar fitting at the bottom of the fixture and wired this with a separate circuit of No. 12 wire. This plug had no switch and the circuit was fused separately and could be used for devices using as high as ten amperes.—C. T. P., San Francisco, Cal.

The writer knows of no proposed increase in size of fixture wire more than the requirement of the new Code concerning all rubber-covered wires. I think such an increase would create a greater abuse of fixture wiring, for if people will now connect a 500-watt iron to a lamp socket that is only intended for, say, 200 watts, what would they do if they knew that the wires were larger? Perhaps they would connect an electric range or some other current-consuming device to the socket. To avoid this evil the contractors should talk of the advantages of installing more baseboard and wall outlets, so that the customer could have ample means of connecting vacuum cleaners, flatirons, fans and anything he might wish to use, of 500 watts or less. The customer should also be taught that electric fixtures as a rule are only wired for a very slight increase in current more than originally supplied, and should be used for nothing but the purpose of lighting.—E. D. D., Del Rio, Tex.

No. 202.—REWINDING MOTOR.—What size wire should be used to rewind a one-half-horsepower, 220-volt, direct-current, bipolar, shunt-wound motor to be used as a generator to deliver 15 amperes at 30 volts? How many turns should there be in each armature coil? How many feet of wire in the field coils?—G. R. L., Sioux Falls, S. D.

Answering this question in the only way possible without knowing the size of cores, slots, etc., would suggest that G. R. L. decrease the number of turns in both armature and field in the ratio that he wishes to change his voltage from 220 to 30 and increase the copper wire area per turn in the same ratio. Further, it is likely that he will be able to parallel his armature windings and commutator bars so that by merely reconnecting these he can get his results. He will have to rewind his field entirely, either using new wire of the larger area or paralleling the old so that the result is the same. This latter is hard to do, unless the various strands are wound on at one time, as different locations in the coils may mean very much greater resistance with the same number of turns.—W. M. P., Seattle, Wash.

No. 10 B & S wire would be a safe size to use in the case. As to the second part of the question, I would suggest that as nearly as possible, one-

seventh the number of turns be put in each armature coil as at present and that the field coils be left as at present. Any slight variation in voltage due to the impossibility of evenly dividing the turns by seven or to the fact that 30 is not exactly one-seventh of 220 can be taken care of by the field rheostat, or by varying the speed, or both.—J. H. M., San Francisco, Cal.

No. 203.—SERVICE-ENTRANCE CONDUIT.—When the wires of service companies are run aerial, would the Code require sealing the ends of the conduit that runs down the side of the pole and from the base of the pole underground into the basement?—G. R. L., Sioux Falls, S. D.

I would suggest that the best plan would be not to seal the end at the bottom, because if this is done and any moisture accumulates within the conduit it could not drain out, and if the upper end be turned drip-loop style, I should say the best plan would be to leave both ends open as to get the benefit of any circulation of air that might occur through the conduit.—W. A. M., Cold Spring, N. Y.

The rule is for underground systems alone. In your case you are only required to keep the conduit waterproof, equipped with a standard service head and the inner end must extend to and properly enter the cutout cabinet.—H. E. W., Chicago, Ill.

The question is not very plain; it may mean sealing only the two ends of the run of conduit, or at every coupling or joint. In the first case of sealing only the two ends, the Code requires an approved fitting at each end as stated in rule 28*d*, with separately bushed holes for each conductor. The type F Condulet as put out by the Crouse-Hinds Company makes a good fitting for outside use, because it protects the interior of the conduit from rain and other injurious effects that might otherwise get in and cause trouble. For the inside end there are numerous fittings for one to choose from. In the second case of sealing at every joint, I find nothing in the Code that requires it. Of course, it is understood that the taper in the thread of the conduit makes a snug fit; providing the work is done right this should help to keep the moisture out. A great many good, practical electricians, however, cement their joints when on a job of that kind. In my opinion it makes a safer job when installed underground outside.—W. T. E., Seymour, Conn.

Philadelphia Electrical Conference.

The regular meeting of the Philadelphia Electrical Conference was held February 26 at the meter department headquarters of the Philadelphia Electric Company, Eleventh Street, Chairman Devereux presiding. This was one of the best meetings held by the Conference, there being about 250 members present, and as the subject "The National Electrical Code" was of vital interest to all present, the discussion was very spirited.

Louis J. Grossman, chairman of the Committee on Organization, submitted his first report. M. E. Arnold made a short address on "Co-operation" which was well received, and W. K. Kerford, vice-chairman of the Conference, spoke of the willingness of the Philadelphia Electric Company to assist the contractor in every way, especially in the way of two-phase motors and similar devices. There was further discussion on switchboards and also on motor control. Among those taking part in the discussion were Messrs. Barry, Buchanan, Eckstein, Schwartz, Dunn, Grossman, Kerford, Loveland, Marley, Saeta and Smith.

The good resulting from these meetings is becoming more apparent and an invitation is extended to all persons interested to attend these meetings held the fourth Thursday of each month at 226 South Eleventh Street. The following officers will serve during the ensuing year: Washington Devereux, chairman; William Kerford, vice-chairman; Herman Eckstein, treasurer; Richard H. Silbert, secretary.

Annual Westinghouse Dinner.

On the evening of March 7, at the Fort Pitt Hotel, Pittsburgh, Pa., the Westinghouse interests of the Pittsburgh district held their fourth annual banquet under the auspices of the Westinghouse Club. The interests represented were the Westinghouse Air Brake Company, the Westinghouse Electric & Manufacturing Company, the Westinghouse Machine Company, the Union Switch & Signal Company, the R. D. Nuttall Company and the Pittsburgh Meter Company. There were approximately 500 Westinghouse men present. Following the banquet the evening was devoted to speeches, songs and moving pictures.

One of the most striking features of the arrangements made by the committee was the installation by the Union Switch & Signal Company of a standard semaphore. This semaphore was electrically operated and controlled from the speaker's table, and the object being to furnish a warning to the speakers should they exceed the time limit. A small card was distributed giving the explanation of the signals as follows: green—proceed; yellow—proceed under forced draft in order to finish before the next signal; red—stop! danger! Considerable humor was interjected by the operation of these signals during the evening. The toastmaster was W. A. Bole, assistant general manager of the Westinghouse Machine Company and director of the Trafford City Foundry.

A. L. Humphrey, vice president and general manager of the Westinghouse Air Brake Company, spoke on the product and the possibilities of that company. In the course of his remarks he called attention to the fact that the company since its organization had never failed to meet a payroll on time, nor passed a dividend, executed a note or issued a bond. It has manufactured during 45 years of existence a sufficient number of brakes to equip a train of cars, which, if placed on one track end to end, would encircle the earth. The speaker unhesitatingly placed the air brake as one of the greatest inventions of the nineteenth century.

Col. H. G. Prout, vice-president of the Union Switch & Signal Company called attention to the value of the automatic signal system as an aid to travel. He called attention particularly to the recent accident at the interlocking tower of the Boston & Maine Station at Boston, which caused the company to annul 239 trains a day; the loss of passenger revenue to the company was very serious but by no means to be compared with loss to the public using this station.

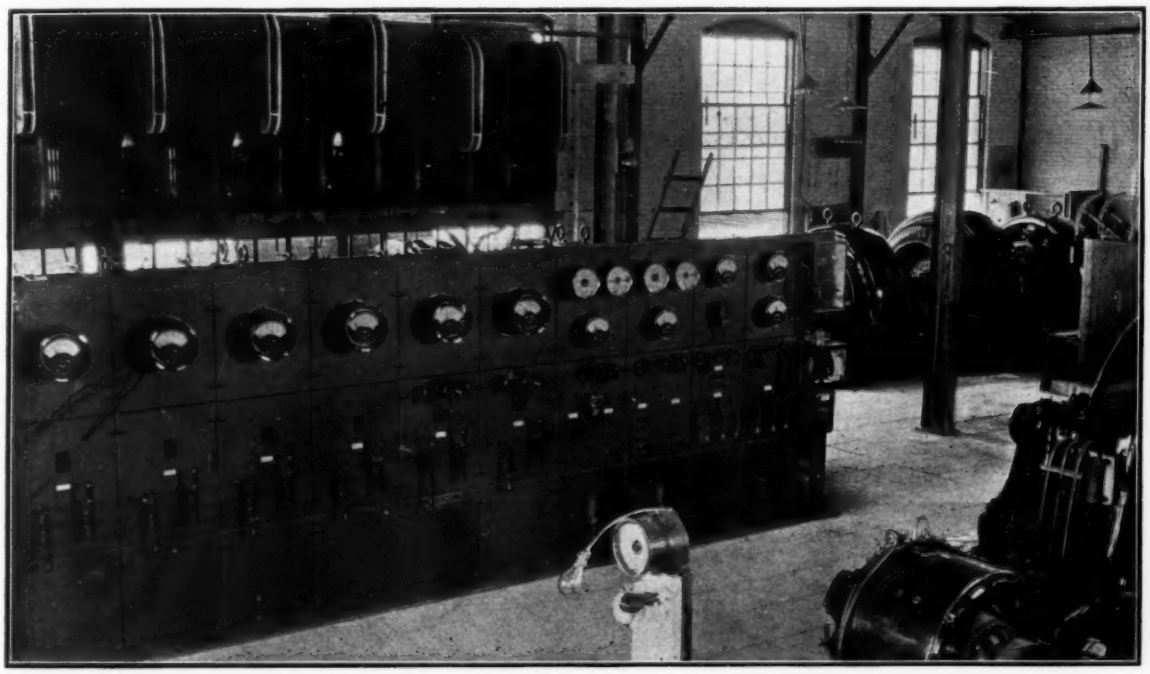
C. A. Terry, vice-president of the Westinghouse Electric & Manufacturing Company, spoke on the recent achievements of that company. In the course of his remarks he said that "deeds are men," and therefore a story of the accomplishments of the company would necessarily be a story of the men responsible for the same.

The main address of the evening was that of Guy E. Tripp, chairman of the board of directors of the Electric Company, who discussed the administration bills now before Congress looking to the regulation of trade. Mr. Tripp said he fully endorsed the principle laid down by President Wilson that "private monopoly is indefensible and intolerable" and believed that its prohibition would do the things that President Wilson says it will do. The speaker stated that he yielded to no one in his respect for the institutions of the United States, and particularly for the high office of its president, and he furthermore regretted to see growing up in this country, particularly among the young people, the lack of respect for our laws and executive authority. Mr. Tripp discussed in some detail the various proposed bills. He summarized his suggestions as follows:

"The suggestion is that the Trade Commission Bill be modified along the lines I have outlined, and that the Sherman Law Definitions Bill and Trade Relations Bill be abandoned altogether because all the acts prohibited or defined in these bills can be prohibited or defined by the trade commission itself. That the Interlocking Directorates Bill be greatly modified and that the Anti Holding Bill confine itself practically to prohibiting a holding company from owning securities of competing corporations."

The Electrification of the Butte, Anaconda & Pacific Railway.

The Butte, Anaconda & Pacific Railway is in many ways one of the most remarkable examples of steam-railroad electrification in this country. Besides being the first 2,400-volt direct-current railway, it is also credited with being the first steam road operating both freight and passenger schedules to electrify its lines purely for reasons of economy. A number of steam railway electrifications have been made because of peremptory factors, such as terminal and tunnel operation or for rapid suburban service. This Montana road, however, cannot be classed as an "enforced electrification," since no such special limitations were the determining factors.



View in Anaconda Substation, Showing 2,400-Volt Direct-Current Switchboard and Motor-Generator Set.

Electric locomotives were first put in service on this line on May 28, 1913. During the first seven months of service, they made approximately 201,000 miles and hauled about 2,365,000 tons of ore. The electric locomotives were described at length in the ELECTRICAL REVIEW AND WESTERN ELECTRICIAN of June 14, 1913, pages 1292 to 1294.

The steam-locomotive crews, consisting of engineman and fireman, easily acquired proficiency in handling the electric locomotives; in fact, two or three days' instructions from a competent electrical man were ordinarily sufficient. The change from steam to electric haulage was made without any change in the personnel of the train crews and without any delays or alterations in the schedule. The enginemen, without exception, have expressed themselves as being greatly pleased with the easy operation of the locomotives.

The electrified lines of this system extend from the Butte Hill yard to the smelter at Anaconda, a distance of 32 miles. There are numerous sidings, yards, and smelter tracks that have been equipped with overhead trolley, making a total of about 95 miles on a single-track basis.

The Butte, Anaconda & Pacific Railway is essentially an ore-hauling road, the freight traffic from this source originating at the copper mines located near the top of Butte Hill. From the mines, the ore trains are lowered down the mountain a distance of 4.5 miles to the Rocker yards located a few miles west of the city of Butte. At this point, new main-line trains are made up for transportation to the smelters at Anaconda. The main-line division extends through a rough mountainous country, a distance of about 20 miles, with grades as high as 0.3 per cent.

At East Anaconda, the main-line trains are broken up and hauled up Smelter Hill to the stock bins, where each car is run over the scales and weighed. The shifting of cars in connection with weighing and subsequent delivery to the concentrators is done by single locomotives.

The east-bound traffic consists in returning empty cars to the mines and the transportation of copper ingot to the Butte yards, where it is shipped over other roads to refineries.

Between the cities of Butte and Anaconda, at the ends of the electrified portion of the system, there is considerable local traffic, both passenger and freight. The city of Butte and vicinity has a population of about 65,000, and Anaconda about 10,000. At Butte this railway connects with three transcontinental railways and for a distance of 16 miles it is paralleled by two of these lines, the Northern Pacific and the Chicago, Milwaukee & St. Paul. The last-named railway company has already contracted for power for the operation of electric trains from Harlowton, Mont., to Avery, Idaho, a distance of 440 miles.

The maximum curvature on the system (20 degrees, 285-foot radius) occurs on the Butte Hill line. On this part of the road there is an average curvature of 6 to 10 degrees. The locomotives are designed with sufficient flexibility to take a curve of 31 degrees (180-foot radius) at slow speed.

The freight traffic consists largely of copper ore and amounts to more than 5,000,000 tons per year. This material is handled in steel ore cars weighing about 18 tons and having a capacity of 50 tons each. Trains of 30 loaded cars weighing 2,000 tons are made up at the Butte Hill yards and hauled by two-unit locomotives to the Rocker yards, where 4,000-ton trains are made up for the main line. At the East Anaconda yards, the trains are again broken up and 1,400-ton trains are sent up Smelter Hill to the ore bins. All of the shifting and spotting of cars, at the smelters and in the sorting yards is done by single locomotive units.

Eight passenger trains per day are operated between Butte and Anaconda, four in each direction. The main-line trains

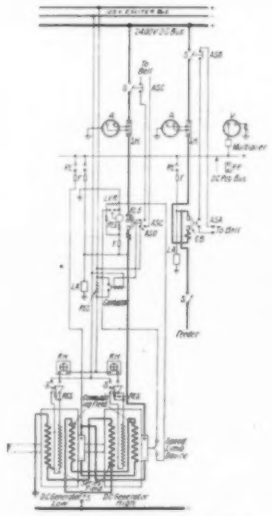
were first hauled by electric locomotives on October 1, 1913, and promptly demonstrated their ability to make better time than was possible with steam engines. Single locomotives are used, hauling trains of from three to five passenger and baggage cars.

Energy for the operation of electric trains is purchased from the Great Falls Power Company. The generating plant is located at Great Falls, Mont., on the Missouri River, and has for some time been supplying electric power for the operation of the mines and smelters at Butte and Anaconda. Six hydroelectric units are installed, having a nominal rated capacity of 21,000 kilowatts. The machines are of the horizontal type, generating 6,600 volts, three phase, at a frequency of 60 cycles. The power is stepped up to 102,000 volts for transmission to the transformer substation at Butte, a distance of 130 miles, over two separate parallel lines constructed on the same right of way. An extension of the system transmits power at 60,000 volts to a second transformer station at Anaconda, 26 miles farther on.

The Butte substation forms the center of the extensive power system operated by the Montana Power Company. Besides the Great Falls 102,000-volt transmission lines, there are several 60,000-volt transmissions terminating at this point, which form a part of the Montana Power Company's system. These lines bring in power from the Hauser Lake, Canyon Ferry, Madison and Big Hole plants. At the Butte substation this power is stepped down to 2,400 volts, three-phase, and all of these lines are tied in on the 2,400-volt bus. Ample protection is therefore afforded from interruption of service.

It is an interesting fact that the railway load was taken on without any increase in the high-tension transmission facilities. It is estimated that the additional load from this source is approximately 20 per cent of the railway, industrial and lighting load furnished by the street railways, mines, and smelters at Butte and Anaconda.

The two existing substations at Butte and Anaconda were used to house the



Direct-Current Wiring of Substation.

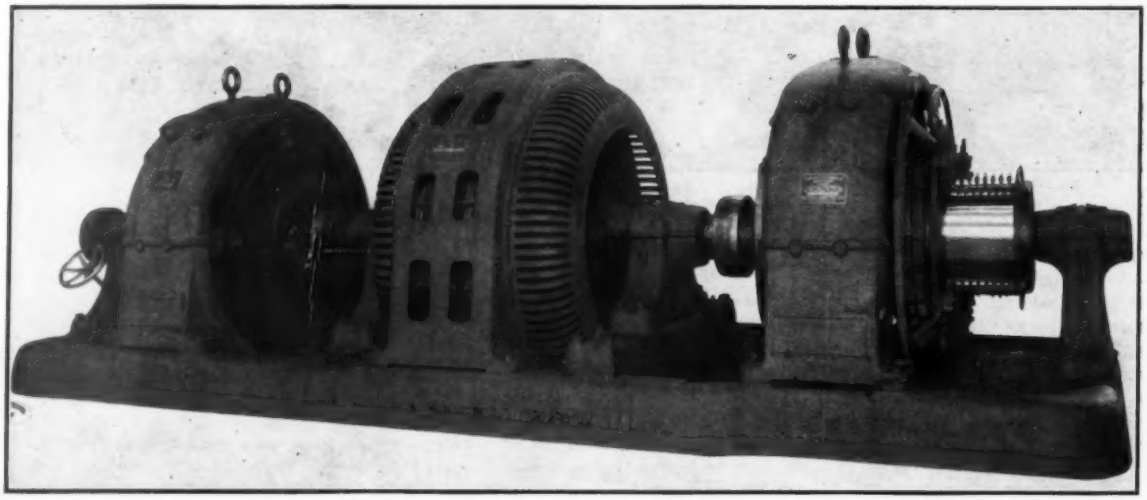
2,400-volt equipment required for operating the electric trains, so that no additional buildings were constructed for this purpose. Power is furnished by two 1,000-kilowatt, 3-unit motor-generator sets in each substation, taking power from the 2,400-volt alternating-current buses. These units operate continuously 24 hours per day, seven days of the week, to supply the necessary current for train operation. Each set consists of a three-phase, 60-cycle, synchronous motor running at 720 revolutions per minute and direct-connected to two 500-kilowatt, 1,200-volt direct-current generators, insulated and connected to operate in series for 2,400 volts. The generators are compound-wound and have both commutating poles and compensating pole-face windings. These fields are connected on the grounded side of the armature, and the main fields are separately excited. The 1,200-volt generators are provided with heatproof insulation and, owing to their unusually good commutating characteristics, will carry three times normal load for periods of five minutes, as well as the usual 50 per cent overload for two hours.

An automatic voltage regulator is used to maintain an approximately constant voltage at the terminals of the motor by power-factor regulation. The motors are protected against overload by inverse-time-limit relays, which are set to open at four times normal load. These relays have been adjusted to open under sustained overload in about two seconds and upon short-circuit their action is practically instantaneous.

Excitation for the two generating units in each substation is obtained from two induction-motor-driven sets, rated 50 kilowatts each at 125 volts. One set is used for supplying current to the synchronous-motor fields and is controlled by the automatic voltage regulator. The second unit supplies current to the separately excited fields of the direct-current generators.

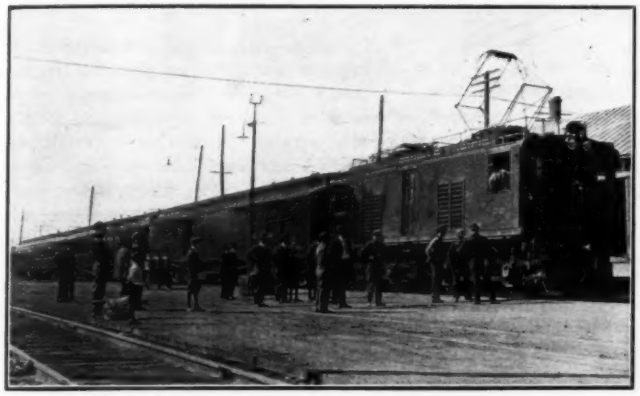
The 2,400-volt switchboards for controlling these sets are said to be the first direct-current boards to be constructed for this voltage. In general, they are similar to the standard 600-volt types with increased insulation and special provision for interrupting the 2,400-volt current. The circuit-breakers and switches are also arranged for remote control, and all apparatus on the panels is provided with ample insulation to insure safety to operators.

The 2,400-volt circuit-breakers and



One of the Substation Motor-Generator Sets—2,300-Volt Synchronous Motor and Two Series-Connected 1,200-Volt Direct-Current Generators.

switches are installed on separate panels above and back of the main panels, and are operated by connecting rods from handles mounted on the front of the main switchboard. These handles are similar in appearance, and to avoid confusion the circuit-breaker handles are inverted. The

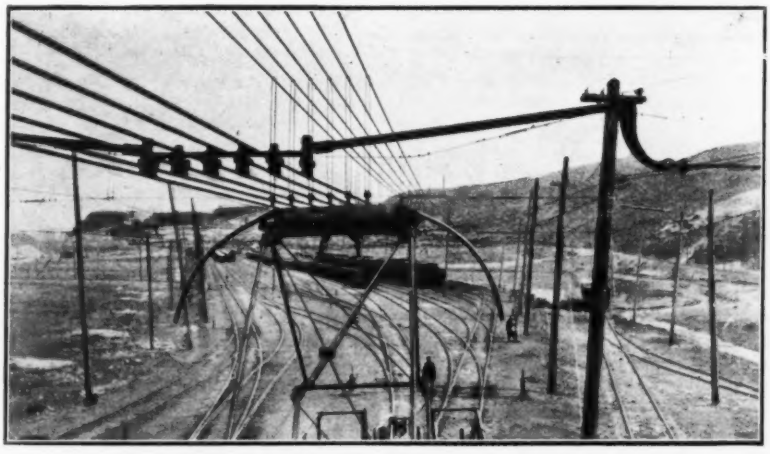


Single-Unit Locomotive with Passenger Train.

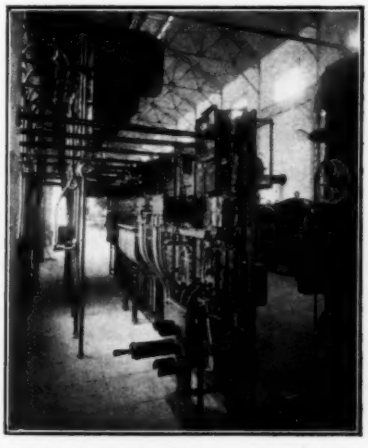
Two-Unit Locomotive Hauling Ore Cars.

breakers are equipped with special magnetic blowouts and arc chutes, and provision is also made for automatically inserting a high resistance in the generator field at the same instant the main circuit-breakers open, thus reducing the generator voltage.

The alternating-current switchboard contains two panels for controlling the synchronous motors by means of remote-control, solenoid-operated oil switches; there are also two panels for the motor fields, and a panel for the automatic voltage regulator. These panels also



A Section where the Pantograph Trolley Engages Six Trolley Wires.



Rear View of Direct-Current Switchboard, Butte Substation.

contain other necessary instruments, including frequency and synchronism indicators, ammeters, wattmeters and relays.

The overhead construction for this system was especially designed to give the flexibility necessary for satisfactory operation of the pantograph trolleys used on the locomotives. The No. 0000 grooved copper trolley used over all tracks is supported by an eleven-point catenary suspension from a stranded-steel messenger cable. Both side-bracket and cross-span construction are used as required by the local conditions. There is a large amount of special work on account of the many yards and sidings, and in one case 12 tracks are spanned. The cross-span construction used at this point is supported by a third pole between the eighth and ninth tracks. The hanger used on the straight-line construction is a rolled-steel strap looped over the messenger wire. This loop is closed at the ear and the wire is clamped in place by a single bolt. Special pull-offs are used to increase the flexibility of the suspension.

The section breakers were designed for the 2,400-volt service, and at six points insulated crossings are necessary at the intersection of the 2,400-volt trolley with the 600-volt trolley of the city street-railway system. On the main line a very simple section insulator is used. This consists of paralleling the two trolley wires from the ends of each section at a suitable distance for insulation so that the pantograph bridges the two circuits for a short distance, thus avoiding interruption of the power supply to the locomotive. The construction in the yards and sidings is simplified by paralleling the trolley from the side tracks for a short distance along the main line. This avoids the use of switch plates or similar devices. At some of these junction points the pantograph engages as many as six trolley wires.

The overhead lines are protected from lightning by 2,400-volt direct-current arresters installed on poles at intervals of one-third of a mile the entire length of the system.

As feeders, the No. 0000 trolley is reinforced between the substations with two 500,000-circular-mil bare copper cables tapped to the trolley at intervals of 1,000 feet. A No. 0000 negative return wire is also installed between Rocker and East Anaconda. This wire is carried on the trolley poles and is connected to the cross bonds at intervals of 1,000 feet. The rails are connected by No. 0000 bonds at every joint. The substations are normally connected together by these feeders, allowing an interchange of current. In emergency either station can supply current to the entire system.

The locomotive equipment consists of

17 80-ton units, 15 for freight and 2 for passenger service. The freight locomotives are geared for slow speed and are operated in pairs for the main-line service. The maximum free-running speed is 35 miles per hour. The two passenger locomotives are of the same construction as the freight units, but are geared for a maximum free-running speed of 55 miles per hour. A speed of 45 miles per hour is made with three passenger coaches on straight level track.

These locomotives are of the articulated double-truck type with all the weight on drivers. The cab contains an engineman's compartment at each end and a central compartment for control apparatus.

The four motors are of the GE-229-A commutating-pole type, wound for 1,200 volts and insulated for 2,400 volts. This motor was designed for locomotive service and is provided with forced ventilation. The double-unit, 160-ton locomotive is capable of giving a continuous sustained output of 2,100 horsepower. The motors are connected to the driving wheels by twin gears similar to those used on the Detroit River Tunnel, Baltimore & Ohio, and the Great Northern locomotives.

The control equipment is Sprague-General Electric Type M, multiple unit, operating the four motors in series and in series-parallel. The 1,200-volt motors are permanently connected in series. The controller provides ten steps in series and nine in series-parallel. The transition between series and series-parallel is affected without opening the motor circuit, and there is no appreciable reduction in tractive effort during the change. The transfer of circuits at this point is made by a special change-over switch, which is operated electro-pneumatically.

Current is collected by overhead roller pantographs, pneumatically operated and controlled from either engineman's compartment by an air valve. A 2,400-volt insulated bus line runs along the center of the cab roof. These bus lines are connected together by couplers between the two freight units, so that current may be obtained from either one or two collectors.

For operating the control equipment and air compressor and for lighting the locomotive and cars, 600-volt current is supplied from the 2,400/600-volt dynamotor installed on each locomotive. This machine is similar in construction to the 1,200/600-volt dynamotor, having two distinct sets of armature coils wound on the same core and brought out to a commutator at each end. One of these windings is designed for 1,800 volts and the other for 600 volts, the two commutators being connected in series across the 2,400-volt circuit. The load current is taken from the 600-volt commutator.

The mechanical load furnished by the direct-connected blower supplies sufficient curent in the series-field windings to provide for the necessary excitation, so that no shunt windings are required. The blower which supplies ventilating air to the motors consists of a multivane fan mounted on an extension of the dynamoter shaft.

Further details of the locomotive design were given in the preceding article already referred to. All of the locomotives have been maintained by the regular shop force with the assistance of one man experienced in electrical apparatus.

Standard 600-volt lighting fixtures are used on the cars, and each passenger and baggage coach is wired for five

Trestle at Washoi Smelter, Showing Typical Bridge Construction

groups of five lamps in series. The lights in each car are controlled by a suitable master switch and fuse with snap switches in the individual circuits. 36-watt railway type Mazda lamps are used, giving about 26-candlepower at 110 volts per lamp. Lighting current is taken from a 600-volt train-line bus, which is connected to the dynamotor on the locomotives

All of the passenger and baggage cars now used between Butte and Anaconda will be heated as well as lighted by electricity as soon as the equipment can be installed. The cars will be heated from a single heating unit installed underneath the car floor and supplied from a 2,400-volt bus connected directly to the 2,400 volt bus on the locomotive This unit will have a maximum capacity of 25 kilowatts and will be used to heat the air which is distributed to different parts of the car by means of a small motor-driven blower. Cool air will be drawn into the insulated case inclosing the heating units from some point on the roof of the car. After passing over the heating coils the air will be carried through ducts under the floor of the car to radiators placed between alternate seats. The blower has a capacity of from 500 to 1,000 cubic feet of air per minute, and the motor is connected in series with the heating units.

In order to increase the range of the heating equipment to meet the requirements of varying temperatures, provision is to be made for connecting the coils to give a total consumption of 10, 15, 17.5 or 25 kilowatts. The temperature of the car is to be regulated by a thermostat.

All apparatus for the electrification of this railroad was furnished by the General Electric Company, Schenectady, N. Y.

Brady Medals for Safety Work on Electric Railways.

Three medals, of gold, silver, and bronze, to be known as the Anthony N. Brady Memorial Medals, will be awarder for the first time this year by the American Museum of Safety for the best work done during the year by an electric street railway in America in accident prevention and industrial hygiene. The medals have been donated by Nicholas F. Brady, son of Anthony N. Brady, who succeeded his father as president of the New York Edison Company. They will be awarded at the next annual meeting of the Museum of Safety, and thereafter each year.

The gold medal is to be awarded to the railroad which makes the best record. The silver medal will be given to the department of the railroad winning the gold medal which, in the judgment of the railroad's directors, has done the most in obtaining the results for the award of the gold medal. The bronze medal will be presented to the employee who individually, in the judgment of the directors, has done the most to promote safety of life and conditions for good health.

Normal Conditions Restored After Los Angeles Storm.

The transmission and distribution systems of the electric power companies serving Los Angeles, Cal., are rapidly being restored to normal condition after the severe washouts experienced during the recent heavy rainfall. The Southern California Edison Company, which was the most seriously affected, has built a temporary line to take care of its 60,000-volt power line between the Long Beach steam plant and Los Angeles. The 60,000-volt Kern River line has been permanently rerouted so as to do away for all time with the towers which were formerly located on the banks of the Los Angeles River.

Direct-Current Turbogenerators for Combined Electric and Heating Plant in Cleveland.

A meeting of the Cleveland Section, American Institute of Electrical Engineers, was held February 23 in the Electric Building. The speaker of the evening was H. L. Wallau, electrical engineer of the Cleveland Electric Illuminating Company, who presented a paper entitled "Notes on Large Direct-Current Turbine-Driven Generators."

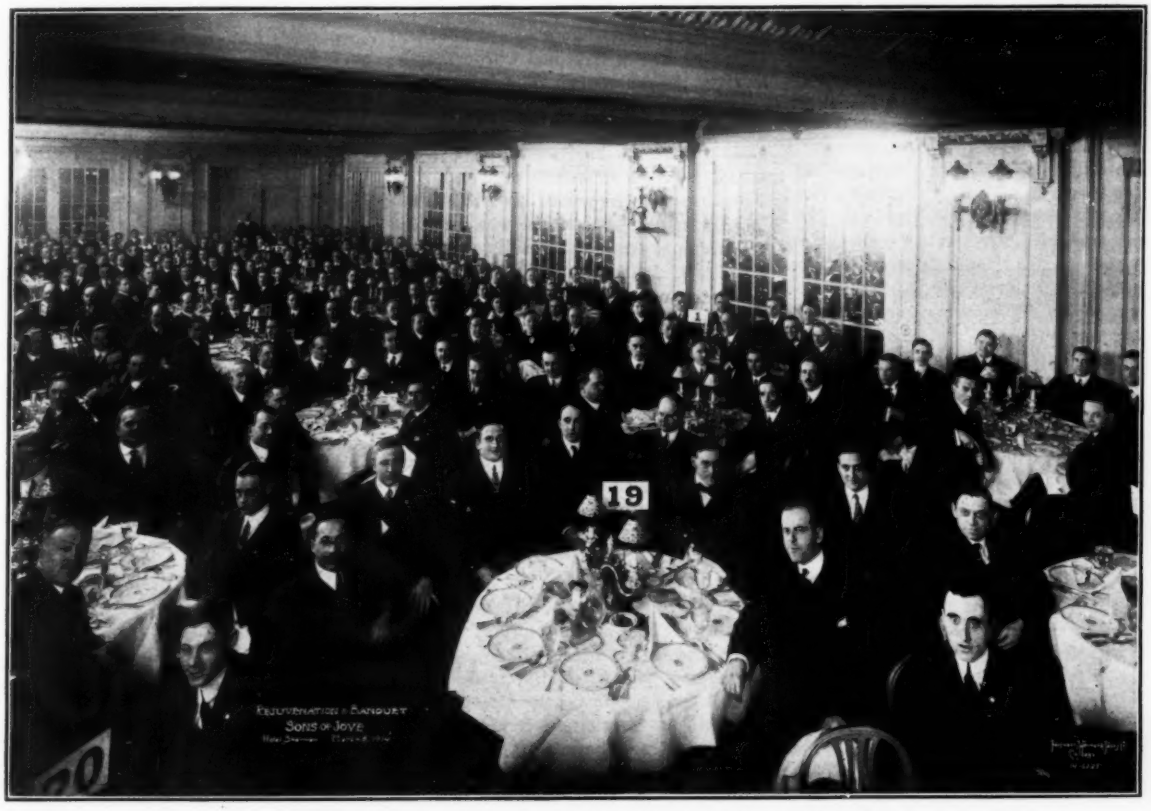
All of the power and lighting circuits of the downtown district of Cleveland are of the Edison three-wire direct-current type. The Cleveland Electric Illuminating Company has also installed steam-heating lines for the downtown office buildings, and the demand for this steam became so great that it was necessary to either supply live steam into the lines or install some machines which were non-condensing and would exhaust the steam into the lines. About a year ago it was therefore decided to install two 3,750-kilowatt, 275-volt direct-current turbogenerators with a 10 to 1 McAlpin reduction gear. Owing to the enormous quantity of steam used in this heating system there is a back pressure of about 15 pounds, so that electricity becomes the by-product instead of the steam as in most heating systems. The Cleveland Electric Illuminating Company now has 900,000 square feet of radiating surface used for heating purposes. The peripherial speed of the armature of these turbogenerators is 8,500 feet per minute and of the commutator 4,250 feet per minute. The turbine weighs 153,000 pounds, the gear 40,000 and the generator 163,000 pounds.

Chicago Jovians Active—Homer E. Niesz Endorsed For Next Jupiter.

An enthusiastic rejuvenation was conducted under the auspices of the Chicago Jovian League at the Hotel Sherman on the evening of Thursday, March 5. A class of 69 candidates were initiated into the Order. Prior to the rejuvenation ceremonies dinner was served in the Crystal room and brief talks were made by Sam A. Hobson, A. A. Gray, Martin J. Wolf, Perry A. Boole and George C. Richards. A feature of the evening was a novel plan introduced by Fred W. Harvey, treasurer of the Chicago Jovian League, for the securing of funds for the local order. By the sales of printed badges numbered from one to 350 in the neighborhood of $300 cash was secured. Those drawing numbers between 336 and 340 were given a pair of sterling silver Jovian cuff buttons; those drawing numbers between 341 and 345 were given gold-filled cuff buttons, and those drawing numbers between 346 and 350 were given solid-gold cuff buttons.

Amid wild enthusiasm the nomination of Homer E. Niesz for the next Reigning Jupiter of the Jovian Order was endorsed by the Chicago Jovian League. Mr. Niesz is a statesman for Chicago and president of the League.

On Monday, March 9, the League listened to an address by Taliaferro Milton, engineer of the Electric Storage Battery Company, on electric storage batteries. Mr. Milton described particularly the function of the central-station battery and included in his remarks also a description of the use of the storage battery in electric vehicle propulsion, for supplying current for exciters in large central stations, and for operating motor-controlled switches, etc.



Group at Banquet of Jovian Rejuvenation in Chicago, March 5.

At this meeting announcemet was made of the appoitment of W. J. Norton, of the engineering firm of Norton & Bird, as statesman-at-large.

A plan was also announced for strengthening the organization of the Chicago Jovian League and the establishment of yearly dues, the organization to include an associate membership of Jovian apprentices who would be given the opportunities of the meetings for a probationary period of one year upon the payment of the dues.

Annual Dinner and Joint Meeting of Boston Engineers.

The fifth annual dinner and joint meeting of the American Institute of Electrical Engineers, the Boston Society of Civil Engineers and the American Society of Mechanical Engineers was held March 4 at the Boston City Club. N. J. Neall presided and introduced H. E. Clifford, of the electrical engineering department, Harvard University, as the toastmaster. Professor Clifford presented the speakers with witty remarks and original poetic characterizations.

Guy E. Tripp, chairman of the board of directors of the Westinghouse Electric & Manufacturing Company, was the principal speaker, his subject being "The National Government and Business." Mr. Tripp outlined the measures now before Congress, known as the "Five Brothers Bills": (1) the Interstate Trade Commission Bill which aims to establish a body with authority to inquire into businesses and report to the Attorney General any violations of the Sherman Act; (2) the Interlocking Directorate Bill, which prohibits directors of corporations engaged in manufacturing transportation commodities from acting as directors of railroads or public service corporations doing an interstate business; (3) the Sherman Law Definitions Bill; (4) the Trade Relations Bill, which prohibits discrimination in prices for the purpose of injuring or destroying a competitor, and (5) the Anti-Holding Bill, not yet drafted.

The attitude of most business men toward this legislation is one of taking chances upon it as an added "business risk." The legislators advocate such measures because of popular demand, rather than from any thorough knowledge of the requirements of business. No class of men are better equipped to judge the amount of injury which may result from various plans of government regulation than the business men themselves. Therefore business men should give careful consideration to all these regulatory measures, to the end that a more intelligent public opinion be created.

"Personally, I believe some regulation is necessary," said Mr. Tripp, "not, however, from the standpoint of business efficiency or economical development of the wealth of this country, but because under our political institutions I prefer to see the menacing qualities of monoply held in check by the establishment of conditions of sane competition rather than by strong direct governmental influence such as Germany exercises." The speaker outlined the German policy of encouraging monopoly but holding it from encroaching on the public welfare; at the same time the German Government owns the railroads and coal mines and engages in other business for the purpose of holding monopoly in check. "I prefer to see in this country conditions for fair competition established by proper legislation, if it can be done, rather than to see government ownership of railroads and other businesses for the purpose of securing the needed balancing influence," said Mr. Tripp. The drawing of a line of capitalization above which certain prohibitions are effective would be regrettable, however, and repugnant to the principles of this government.

The framing of specific business legislation is found to be so difficult that the task of determining whether acts are in violation of the Sherman Anti-Trust Act should be left with the Trade Commission, the speaker held. This Commission should collect information, conduct investigations and determine facts; but for its agents to search the books and records of a company, as if armed with a search-warrant, is obnoxious. The information obtained should be accessible to the public only upon approval of the Commission, and not available to competitors and others with purely selfish motives.

The speaker suggested that the Commission might assume the responsibility of bringing about the results sought in the Trade Relations Bill which aims to do away with some very objectionable practices, but to forbid them specifically it may be necessary to use language which will make the statute apply to such an extent that business would be greatly hampered, providing the law could be enforced. A properly framed Trade Commission bill would be better than specific legislation which might give rise to confusion. The Commission might also have the right to approve the legality of mergers.

Mr. Tripp held that the Interlocking Directorates Bill as now drawn is too drastic. It really almost prohibits a man from holding a directorship in any two companies, and tends to create dummy boards and one-man-power corporations. The bill in its present condition would perhaps do more harm than good.

Standpatters should not condemn indiscriminately all the proposed measures, said the speaker. What is needed is constructive criticism, to encourage safe and sound legislation. "One of the great principles supported by public opinion is that competitive conditions should be maintained, but the public does not discriminate between free competition and fair competition." "There is no better basis upon which to found monopoly than free competition. A great monopoly was built up on these principles, by the underselling of a competitor in his locality until he was stamped out." This kind of competition is to be prevented by the Trade Relations Bill which forbids "any person in interstate or foreign commerce to discriminate in price between different purchasers of commodities in the same or different sections or communities, with the purpose or intent to thereby destroy or injure a competitor." The bill also prohibits anyone from making sales or fixing prices on the condition that the purchaser shall not deal in a competitor's goods.

"Instead of framing statutes to meet these conditions which are almost sure to ramify further and forbid quite harmless and proper business transactions, the duty of deciding whether a specific act is in violation of the principles of fair competition might well be performed by a commission," said Mr. Tripp.

Prof. A. E. Kennelly was the next speaker, taking as his subject: "Results for the Engineering Fraternity Accomplished by the I. E. C." He said facetiously, that most of the troubles of modern civilization—the steamships that bring hordes of immigrants, the railroads, the high buildings—are the result of engineers' activities, and therefore engineers should help solve these problems. The International Electrotechnical Commission, he said, has accomplished a great benefit in formulating uniform international definitions for engineering terms and symbols. He spoke of the language difficulties of the conferences and complimented Mr. Mailloux, president of the American Institute of Electrical Engineers, on his activities in the I. E. C. It was due to the latter that the language of reference in the Commission is French. Prof. Kennelly voiced the hope that universal I. E. C. ratings of machines in all countries would be brought about.

President C. O. Mailloux discussed the importance of the engineer in modern civilization, commented favorably on the Harvard-Technology alliance, and referred to the Stone & Webster organization as an excellent training school for young engineers.

President James Hartness of the American Society of Mechanical Engineers pointed to the progress Germany has made in business, saying: "If we are to look to the welfare of our country we must let people know that they are not to break up big organizations and disintegrate the things that are best ordered for the good of our people."

Dr. M. W. Franklin, of the Sprague Electric Works, Bloomfield, N. J., spoke wittily on the evolution of the engineer.

University of Wisconsin to Organize Mechanic's Institute.

The demand for professionally trained mechanics to teach in industrial schools has led the regents of the University of Wisconsin to create 15 industrial scholarships, the holders of which will be organized into a mechanics' institute. Intensive practice in special lines of shop work and drawing, and detailed consideration of organization and teaching problems that confront industrial schools will be given at the institute which will be held from March 9 to April 9.

Boston Electric Vehicle Meeting.

Signalizing the third anniversary of the initiation of electric vehicle work through the Electric Motor Car Club of Boston, the members of that organization, together with other interested men, and also public officials of the state and city, were the guests of the Edison Electric Illuminating Company of Boston at the American House on the evening of March 3. About 160 were present.

President Frank W. Smith of the Electric Vehicle Association of America was toastmaster, being introduced by Day Baker, president of the Boston Electric Motor Car Club. Mr. Smith complimented the Boston organization on its work in the electric-vehicle field. The Boston Edison Company, he said, had led in central-station support of vehicle interests. Lieut. W. J. Keville, of the governor's staff, brought the greetings of Governor Walsh.

Edward S. Mansfield, vice-president of the Motor Car Club, told of the formation of the Electric Vehicle Club in March, 1911. He stated that the Boston Edison Company maintains a bureau of education for electric-vehicle users and provides electric signs for garages furnishing charging facilities. In the Boston Edison Company's territory there are now 255 passenger electrics and 208 electric trucks, as against 119 passenger and 50 commercial cars in 1910, a gain of 114 per cent in the former and 316 per cent in the latter, in three years' time. Figures for the state of Massachusetts show an increase of 146 per cent in vehicles of both types. Mr. Mansfield pointed out that if all New England were covered by electrics to the degree that the Edison territory is covered, the advantages to central stations would be very great.

Mayor James M. Curley of Boston voiced his interest in improved transportation facilities in the city, praised the Boston Edison Company for its enterprise, and advocated bringing about of more uniform labor laws throughout the country, to the end the Massachusetts, with its close restriction of labor hours and conditions, should not be at so great a disadvantage in competing with the manufacturers of other states. The mayor pointed out that the city is soon to make a new contract for street lighting.

Charles H. Miles, head of the vehicle work for the Edison Company, spoke on "Plans for the Future." He said that the severe snowstorms of the present winter have demonstrated the ability of the electric to cope with the heavy conditions of the streets. Few disabled cars have been towed in. He announced that large users of this type of transportation in Boston are adding to their fleets; one company is about to add eight trucks. Pleasure-car sales are encouraging, despite the curtailed incomes of many people of means. Mr. Miles believed the proposed low-priced Ford electrics would not hurt the sale of the higher-priced cars but would help the whole industry through the popularizing of the electric.

Mr. Mansfield announced that to meet the need of parking facilities the Head Place archway at the Edison Company building will be available for electrics during theater hours.

P. D. Wagoner, president of the General Vehicle Company, Long Island City, New York, spoke on the subject, "Financing the Electric." A sum of about $13,000,000 is invested in the 60,000 motor vehicles now in use, and the prospects are that a quarter of a billion dollars will be the ultimate yearly investment. The present vehicles replace only two per cent of the horses of the country. Increase this replacement to 25 per cent and the result is 1,000,000 trucks, which, at the low estimated value of $1,000 each, means a total investment of a billion dollars. With 500,000 trucks the investment, coupled with that of garaging facilities, will easily reach a billion and a quarter of dollars, or some $125,000,000 per year for ten years. This investment would be balanced by $130,000,000 worth of dead horses, whose average useful life is about six years. Trucks have twice the life and three times the efficiency of horses.

Mr. Wagoner held that the gradual substitution of the electric truck for the horse is the most satisfactory method, rather than vehicle manufacturers becoming bankers and carrying the burden of financing too large an output. Co-operative delivery systems are objectionable, as merchants on the whole prefer to retain their individuality. Banks should finance the motorization of mercantile houses. A company that can show a saving in delivery costs of 2.5 cents per package, representing about 27.5 per cent on the investment, is readily accorded banking accommodation. "The motor truck is the product of economic law and its use is becoming imperative," said the speaker. "Highway transportation is the one great opportunity for reducing costs."

H. H. Rice, vice-president of the Waverley Company, Indianapolis, urged a mastery of facts and figures as the best equipment for an electric-vehicle salesman.

Prof. D. C. Jackson said that the industry is still in its infancy. The doom of the horse was sounded when quick unloading facilities were devised.

Col. W. D. Sohier, chairman of the Massachusetts Highway Commission, and J. H. MacAlman, president of the Boston Automobile Dealers' Association, also spoke. L. D. Gibbs, superintendent of advertising for the Boston Edison Company, provided the entertainment and musical features.

Public Hearings by Commission on Industrial Relations.

Public hearings in important industrial centers from New York to San Francisco will be held during the spring and early summer by the United States Commission on Industrial Relations. This announcement has been made by Frank P. Walsh, chairman of the Commission. The hearings will embrace in their scope all the main divisions of the inquiry directed by Congress.

Among the cities that probably will be visited are New York, Philadelphia, Boston, Patterson, Scranton, Pittsburgh, Buffalo, Wheeling, Charlotte, Greenville, Atlanta, Birmingham, Nashville, Louisville, New Orleans, Detroit, Indianapolis, Cleveland, Chicago, Houghton, Milwaukee, Madison, St. Louis, Kansas City, St. Paul, Denver, Trinidad, Dallas, Houston or Galveston, Los Angeles, San Francisco, Seattle, Butte and Lead.

Through examination of witnesses competent to speak for employers, trades unions, other labor organizations, unorganized employees and the general public, the Commission hopes to obtain information concerning the industrial situation that will lead to constructive recommendations.

Some of the subjects to be inquired into in each city are irregularity of employment; possibilities of ending irregularity and increasing production through scientific management; the activities of trades unions and employers' associations; and the extent and operation of governmental machinery for regulating the conditions of industry, including the relations between employers and employees. Successful methods of maintaining harmonious relations beneficial to both employers and employees will be inquired into particularly, with a view to their adoption in other centers where no such methods have been tried.

Eminent authorities on subjects to be included within the scope of the inquiry have joined the staff of the Commission and are now aiding in planning the hearings. Witnesses desired by the Commission will be summoned under the authority granted it by Congress, and volunteer testimony will be welcomed.

Announcing the plan for hearings, Chairman Walsh said: "The Commission will carefully avoid acting as

a board of mediation and conciliation, and will not allow itself to be drawn into local controversies or recognize such controversies unless in doing so it can obtain information that has more than local and temporary significance. Every interest will be given a hearing. The Commission will strive to put aside all bias and prejudice. It will urge others to do the same, in the hope that the industrial problem may be studied in the light of reason. The open mind will be our watchword, and we shall endeavor to provide a forum where men representing all factions can meet in the common purpose of finding a way out from bitterness and strife. To accomplish this we shall need the co-operation and help of all concerned. We shall ask those who meet with us at the hearings to come not as employers or employees, but as men belonging to the same human family. The hearings are to be undertaken as one means of carrying out the instructions of Congress to inquire into the industrial situation and to report our conclusions and recommendations. The Commission wishes in particular to invite the help of every person who has a constructive suggestion. Such suggestions will be especially welcome when they are supplemented by testimony as to the successful carrying out of the ideas they embody."

According to present plans the hearings will begin in the latter part of March.

German Radiotelegraphic Stations in the Pacific.

The first German radiotelegraph station in the Pacific was opened in November, 1909, on Yap (or Uap) Island, in the Carolines, situated about 10 degrees north and to the north of New Guinea. The station was built by the Telefunken Gesellschaft on behalf of the Deutsche Südsee Phosphat Gesellschaft. Yap is connected with the cable system of the Deutsch-Niederländische Telegraphen-Gesellschaft (of Cologne) by three cables to Shanghai, in China, to Guam, and to Menado (on Celebes, Dutch East India). For this reason Yap was selected as a radiotelegraphic center, and further stations have now been erected at Rabaul (seat of the Governor of German New Guinea), at Nauru (in the Marshall Archipelago), and at Apia, in Samoa (14 degrees south); a station on Angaur Island had been built at the same time as that on Yap. The distances worked are considerable. Yap-Rabaul is 2,200 kilometers, Yap-Nauru 3,400 kilometers, Nauru-Samoa 2,700 kilometers, and New Guinea-Samoa 4,000 kilometers. The distance Yap-Tsingtau (in Shantung) is 3,650 kilometers, almost exactly as far as from Clifden, in the West of Ireland, to Glace Bay, in Newfoundland. The station at Apia is to be opened this spring, the other stations are already working. The stations are equipped with 60-horsepower oil-engines, and with umbrella antennae 120 meters in height, to work with an energy of 25 or 30 kilowatts, and with waves ranging from 300 up to 2,000 meters; the ordinary wave-length for ship-signaling is 600 meters.—*Engineering.*

Census Report on Central Electric Light and Power Stations.

Preliminary figures of the forthcoming quinquennial report on the central electric light and power stations of continental United States (exclusive of Alaska, Hawaii, Philippine Islands, and Porto Rico) have been given out by the Bureau of the Census.

The statistics relate to the years ending December 31 for 1912 and 1907, and June 30 for 1902, and cover both commercial and municipal electric plants. They do not include electric plants operated by factories, hotels, etc., which consume the current generated, those operated by the Federal Government and state institutions, or plants that were idle or in course of construction.

The figures as presented for continental United States show general gains for the decade 1902-1912. The number of commercial stations or plants increased from 2,805 in 1902 to 3,659 in 1912, or 30 per cent. The number of municipal plants increased from 815 in 1902 to 1,562 in 1912, or 92 per cent. The total income for 1912 amounted to $302,115,599 as compared with $85,700,605 in 1902, or an increase of 252 per cent. The total expenses, including salaries and wages, in 1912, amounted to $234,419,478, as compared with $68,081,375 in 1902, or an increase of 244 per cent. The total number of persons employed in 1912 was 79,335 as compared with 30,326 in 1902, or an increase of 162 per cent. The total horsepower of the steam engines and steam turbines was 4,946,532 in 1912, as compared with 1,394,395 in 1902, or an increase of 255 per cent. The horsepower of the water wheels was 2,471,081 in 1912, as compared with 438,472 in 1902, or an increase of 464 per cent. The output of stations amounted to 11,502,963,006 kilowatt-hours in 1912, as compared with 2,507,051,115 in 1902, or an increase of 359 per cent. The estimated number of arc lamps wired for service in 1912 was 505,395, as compared with 385,698 in 1902, or an increase of 31 per cent. Incandescent and other varities of lamps wired for service, however, numbered 76,507,142 in 1912, as compared with 18,194,044 in 1902, or an increase of 320 per cent. The horsepower capacity of the stationary motors served with electric current amounted to 4,130,619 in 1912, as compared with 438,005 in 1902, or an increase of 843 per cent.

The figures are shown in detail in the accompanying table:

CENTRAL ELECTRIC LIGHT AND POWER STATIONS.

	1912	1907	1902	Per cent of increase: 1902-1912
Number of stations[1]	5,221	4,714	3,620	44.2
Commercial	3,659	3,462	2,805	30.4
Municipal	1,562	1,252	815	91.7
Total income[2]	$302,115,599	$175,642,338	$85,700,605	252.5
Light, heat, and power, including free service	$286,980,858	$169,614,691	$84,186,605	240.9
All other sources	$15,134,741	$6,027,647	$1,514,000	899.7
Total expenses, including salaries and wages[3]	$234,419,478	$134,196,911	$68,081,375	244.3
Total number of persons employed	79,335	47,632	30,326	161.6
Total horsepower	7,528,648	4,098,188	1,845,048	308.0
Steam engines and steam turbines:[4]				
Number	7,844	8,054	6,295	24.6
Horsepower	4,946,532	2,693,273	1,394,395	254.6
Water wheels:				
Number	2,933	2,481	1,390	111.0
Horsepower	2,471,081	1,349,087	438,472	463.6
Gas and oil engines:				
Number	1,116	463	165	576.4
Horsepower	111,035	55,828	12,181	811.5
Kilowatt capacity of dynamos	5,134,689	2,709,225	1,212,235	323.6
Output of stations, kilowatt-hours	11,502,963,006	5,862,276,737	2,507,051,115	358.8
Estimated number of lamps wired for service:				
Arc	505,395	[5]562,795	385,698	31.0
Incandescent and other varieties	76,507,142	[5]41,876,332	18,194,044	320.5
Stationary motors served:				
Number	435,473	167,184	101,064	330.9
Horsepower capacity	4,130,619	1,649,026	438,005	843.1

1 The term "station" as here used may represent a single electric station or a number of stations operated under the same ownership.

2 Exclusive of $36,500,030 in 1912; $20,093,302 in 1907, and $7,703,574 in 1902, reported by street and electric railway companies as income from sale of electric current for light or power or from sale of current to other public service corporations.

3 In addition to salaries and wages, includes the cost of supplies and materials used for ordinary repairs and replacement, advertising, fuel, mechanical power, electrical energy purchased, taxes, charges for depreciation, and all other expenses incident to operation and maintenance.

4 Includes auxiliary engines.

5 Includes, for purposes of comparison, 7,082 arc and 267,997 incandescent lamps reported by the electric companies to light their own properties. Lamps used for such service were included in the total number reported in 1912.

California's Joint Committee on Inductive Interference.

California is a state of great distances, and widely scattered centers of population. In general, these centers are at some distance from sources of water power, and at the same time, water is a valuable commodity, owing to the entire lack of rain during the major portion of the year.

Accordingly, hydroelectric plants are located at considerable distances from cities, and steam plants are located near the ocean in order to secure water at reasonable rates. These facts alone make it evident that there should be, and continue to be in the future, a large number of high-tension power lines throughout the state, both to bring power from the hydroelectric stations in the mountains, and from the steam plants at the ocean and to distribute power between communities. The rapid extension of these power lines, operating at potentials varying from 10 to 150 kilowatts, has had a serious effect upon telephone, telegraph and other signal lines, due to inductive interferences where the signal and power lines closely parallel each other.

For a number of years, a more or less acrimonious discussion has been going on, particularly between the power and telephone interests, without any definite results being obtained. principally due to the fact that the power engineer has not understood the telephone engineer's point of view and vice versa. This entire dispute was brought to an issue before the Railroad Commission of the State of California late in the year 1912, by a complaint before that Commission by one of the telephone companies against the operation of a new 57,000-volt line, which closely paralleled the telephone company's lines for several miles.

The Commission was asked to prevent the operation of the power line, as it was feared that inductive disturbances would be introduced on the long-distance telephone lines so as to make the circuits inoperative. The Railroad Commission, in the absence of any definite data on which to base a ruling, wisely proposed the formation of a committee under the authority of the Commission, its membership to be composed of engineers of the telephone companies, engineers of the power companies, and also of the Railroad Commission.

In the meantime, the power company was permitted to energize its line under certain rules of operating, which it was generally believed would minimize the possibility of trouble on the telephone circuits.

The purpose of this committee was to be the collection of data to form the basis for a later order of the Commission regulating the construction of power and signal lines in proximity to each other. This plan instantly met with the approval of the interests involved, and during the early meetings of the engineers, a general plan of experimentation was laid out, and it was at the same time agreed that all power and signal companies within the state, who would signify their willingness to co-operate, should be assessed certain sums of money to meet the expenses of the committee. The assessment was apportioned as nearly as possible in accordance with the relative importance to the individual company of the data to be obtained.

The committee proposed to conduct experiments to determine under various conditions of potential connection and load under what methods of operation power lines could parallel signal lines without introducing unreasonable disturbances. This committee has been conducting its experiments during the. past year and has issued its second progress report, which is of interest to others having similar problems.

Experiments have been carried on, principally at two parallels between the 57,000-volt three-phase line of the Sierra & San Francisco Power Company, and the main Coast line toll lead of the Pacific Telephone & Telegraph Company. These two exposures are respectively 20 miles and 8 miles in length.

From the progress report, the following are some of the general results and conclusions indicated as the outcome of the experiments conducted at the above points.

The fundamental (60-cycle) wave of voltage or current is relatively of little importance in the production of noise in telephone circuits. It becomes of importance, however, if it gives rise to longitudinal voltages of sufficient magnitude to constitute a physical hazard, to interfere with the operation of grounded signaling devices or superimposed telegraph service, or to operate protective apparatus on the circuits.

The harmonics of the voltage and current waves are of chief interest as the cause of noise in telephone circuits, particularly the higher harmonics or those within the range of the voice frequencies.

The fundamental and lower harmonics are important as disturbing factors in telegraph circuits.

The above facts show clearly the great desirability, from the standpoint of inductive interference, of having wave forms of voltage and current in power circuits free from all harmonics. That such does not obtain in the present state of the art is a basic cause of the disturbances to communication circuits paralleled by power circuits. Further than this, these facts emphasize the desirability that designers and manufacturers eliminate, as far as is practicable, those features of design favorable to distorted wave forms.

In order to facilitate the anaylsis of the inductive effects of a power circuit on parallel communication circuits, the voltage and currents of a three-phase power system can be conveniently regarded as made up of components which exhibit distinct characteristics and treated separately. In any three-phase system in which the three voltages between pairs of wires are equal in magnitude, the voltage between any wire and ground can be considered to be the vector sum of two voltages which are called the balanced and the residual components respectively. The balanced components consist of three equal voltages between the three wires and ground, the vector sum of which is zero. The residual components consist of three equal voltages between wires and ground which are in phase with each other. The residual voltage of the system is defined as the vector sum of the voltages of the three conductors to ground. It is, therefore, three times the residual voltage of the individual conductors or three times the equivalent single-phase voltage of the three conductors in parallel with respect to the earth. The currents flowing in the three wires of a three-phase circuit may be considered to be composed of three sets of currents, namely: (1) balanced components consisting of equal currents in each of the three line wires whose vector sum is zero; (2) a single-phase current flowing in a loop composed of two of the wires; (3) a residual current divided equally between the three wires and returning through the earth. Residual current is defined as the vector sum of the three line currents. It is, therefore, the equivalent single-phase current flowing through the three line conductors in parallel, with the earth completing the circuit. Connections of current and potential transformers are arranged for measuring the residual current and residual voltage of power circuits under investigation.

For the purpose of clearness, it is convenient to classify induction phenomena as longitudinal or transverse, referring to their manifestation on a metallic circuit. Longitudinal induced voltage refers to the voltage induced between the circuit and ground in the case of electrostatic induction and along the circuit between the two ends of the exposure in the case of electromagnetic induction. The transverse induced voltage of a circuit is the difference between the longitudinal induced voltages of the sides of the circuit. In the case of electrostatic induction this voltage acts between the two sides of

the circuit and in the case of electromagnetic induction it acts around the metallic circuit.

It has been found in the case of the power lines investigated that the fundamental, fifth, seventh and eleventh harmonics are prominent in the balanced currents and voltages while the fundamental, third and ninth harmonics are prominent in the residual currents and voltages of the power system.

By a comparison of the prominent harmonics in the currents and voltages of the power system with those of the induction in the telephone circuits it is evident that the longitudinal induction arises principally from the residual voltages and currents while the transverse induction shows principally the characteristics of the balanced voltages and currents, together with some effect from the residual voltage and current.

The effect of the condition of the neutral of the autotransformers at Salinas, grounded or non-grounded, in so far as the induction from these exposures is concerned, is through the residual currents and voltages of the several high-tension lines connected to these transformers. A representative value of the neutral current at Salinas during the tests conducted at that point is 0.3 ampere. It is composed almost entirely of ninth harmonic together with the fundamental and third harmonics, decreasing in magnitude in the order named. The length of the power circuit between Guadalupe and Salinas is approximately a quarter wave-length for the ninth harmonic. This fact may have some bearing upon its large magnitude and is to be further investigated by the committee. Under existing conditions with the power system in normal operation, grounding the neutral of the autotransformers at Salinas does not greatly affect the induction in the exposures concerned. Two reasons may be given for this result: (1) the load balance on the power system is such that a relatively small amount of load current flows through the neutral; (2) as three high-tension lines are connected together by the autotransformers at Salinas, opening the neutral connection to ground of these transformers does not completely eliminate the path for the residual current of any one of the three lines, since it may then flow to earth through the admittance to ground of the other two lines. It is quite evident from these considerations that this case presents special conditions which make it impossible to draw general conclusions applicable to any other case. Further consideration of the effect of grounding this neutral will probably be undertaken by the committee with the idea of determining its effect under abnormal conditions.

The banks of star-connected autotransformers at Guadalupe and Salinas substations are provided with closed-delta secondary windings which supply power for local consumption. For test purposes the secondary delta of the transformers at Salinas was opened. A large increase in the residual voltage and residual current with a consequent large increase in the induction in parallel telephone and telegraph circuits resulted. In all cases this increase applied particularly to the third harmonic. If star-connected autotransformers are used this test indicates, therefore, that from an induction standpoint it is beneficial to provide such autotransformers with secondary windings connected delta.

On the eight-mile exposure it was possible to measure separately under different conditions of the telephone circuits, the electromagnetic and electrostatic induction. For this exposure, also, computations of the magnitude of the induction, both electromagnetic and electrostatic, were carried out. In computations of electromagnetic induction, experience has indicated that the distances between wires and their images cannot be assumed to be twice the height of the wires above the ground. Special tests were carried out in order to determine the equivalent depth of the image conductors. The tests indicated this depth to be approximately 300 meters below the earth's surface. Due to the electrostatic shielding effect of neighboring objects it was found, also, that the computed electrostatic induction was greater than that actually observed, indicating that in effect the ground surface was brought nearer to the conductors. Electrostatic shielding of the circuits under test, by grounding other circuits on the telephone lead at one point, reduced the electrostatic induction, particularly the longitudinal induction.

The effect of typical terminal apparatus of a telephone circuit in reducing the amount of extraneous current reaching the telephone receiver was the subject of some investigation. These effects vary with the length of the line and character of the induction.

As a means of minimizing inductive interference, some study has been given to the proper relative transposition of power and telephone circuits. Some of the considerations involved in this study are given in the portion of this report dealing with the future work of the committee.

The report states that the next step will be the investigation of the parallel between the 22,000-volt three-phase line of the Coast Counties Gas & Electric Company, and a toll line of the Pacific Telephone & Telegraph Company between Santa Cruz and Watsonville, a distance of 17 miles. Particular attention will be given at this point to the study of the effectiveness of several different systems of transpositions of power and telephone circuits, and it is hoped by the committee to be able to determine as follows:

(a) The effect of power transpositions in reducing the longitudinal induction arising from balanced currents and voltages.

(b) The effect of telephone transpositions in reducing the transverse induction arising from: (1) residual currents and voltages; (2) balanced currents and voltages.

(c) The effect of power and telephone transpositions properly located with respect to each other in reducing both the logitudinal and transverse induction arising from balanced currents and voltages.

(d) The relative effectiveness of different transposition systems in reducing electrostatic and electromagnetic induction.

Outside of the purely technical and other valuable information which will be obtained by means of this committee, there is before the electrical world today, a valuable lesson in the effectiveness of co-operation where such co-operation is made possible by the intervention of a third party. Whereas, before the formation of this committee, there was a very decided tendency on the part of both interests to best the opposing interest in the location of its lines, there is at the present time a tendency towards co-operation and an endeavor to assist the power engineer or the telephone engineer, as the case may be, in the solution of his individual problem.

Keeping in Touch With Neighborhood Wants at Minneapolis.

Manager R. F. Pack of the Minneapolis General Electric Company has established a policy of encouraging employees of the company to join local improvement clubs and other civic organizations. Usually a man from the sales department is chosen for this purpose but in a number of cases the representatives are from other departments. It is Mr. Pack's idea that his company should participate in all non-partisan community and inter-community movements and he finds the method described effective. Not only is the company enabled thereby to participate in civic advancement but in this way keeps in close touch with the various neighborhood demands and ambitions. Minneapolis is well known as one of the most beautiful of American cities and this fact is due in considerable measure to the activity of its local improvement clubs and associations.

WHERE AND WHY ELECTRIC TRUCKS ARE ECONOMICAL.

By E. J. Bartlett.

The fact that electric trucks are being extensively used in many of the larger cities of the country, and are at least being introduced in most of the smaller cities, is known to most people who are at all interested in the very serious problem of economical and efficient city merchandise transportation. In fact, many men closely in touch with the motor-truck industry predict that within a very few years fully two-thirds of all city trucking will be handled by the electric. It is also becoming very well understood that the electric has a distinct field for its operation in which it is supreme, while the gasoline and horse trucks fill other service requirements to the best advantage. The suitability of the different types is not alone determined by the particular line of trade in question, but rather by the particular work to be done and the local conditions for doing it. You cannot justly say, because a certain company engaged in your line of work and located in another city, or even in your own city, found gasoline trucks unsuitable and returned to horses, or found electric trucks unsuitable and turned to gasoline trucks, that either type of truck is best for you. Your particular conditions should govern your choice, and those alone.

What are the conditions that demand the use of electric trucks to realize their maximum efficiency and economy? There are many combinations of little things, but some of the more important features are set forth in the following arguments and tables.

Mileage Requirements.

The standard electric truck of the best known makes of any load capacity have a mileage range per charge of approximately 40 miles, with a possible 50 miles if needed. It is entirely possible by the use of batteries of larger capacity than standard to obtain 25-per-cent increase in mileage. These figures are based on the much abused phrase, "under normal operating conditions." By this is meant paved streets or good roads and few hills. Electrics will haul their loads over almost any roads which can be used for gasoline or horse trucks, but the consumption of current for bad roads is increased rapidly and out of proportion to the work done, and if such roads are to be traveled a great deal of the time, the performance of the electric will suffer in comparison with the other types of truck service. It is not that the electric will not pull through a soft, muddy road, or climb a 10 per cent grade, for it will; but perhaps three times the current will be consumed than if running on a hard level road, and if the truck has a mileage capacity of 40 miles under the latter conditions, it would have only some 13 miles capacity if constanly climbing a steep hill or plowing through a muddy road, and will travel at a lower speed. Such severe conditions are hard on any type of truck, but the decrease in mileage would make the electric impractical.

On the other hand, suppose it is necessary to climb a steep hill three times a day and go through a short piece of muddy road twice a day. The hard traveling may not be over three miles in all, but the current used may be sufficient to propel the truck 10 miles on hard level streets. You are then sacrificing seven miles on account of the hills and mud, and should you need the full 40 miles a little larger battery would care for the extra work to be done. Many successful electric truck installations are working in hilly cities. The expense is a little more owing to the larger batteries used, but for that matter it costs fully as much more to haul goods uphill with any kind of truck. The essential difference is the limit to the extra battery capacity which can be added to the electric, while the gasoline tank may be filled several times a day if necessary with the gasoline truck.

The electric is not limited by a steep hill or a piece of bad road, but rather by too many of them. Most companies in most cities can use electric trucks so far as mileage requirements are concerned. Level cities or those with few hills and with good hard streets, have natural advantage in favor of the electric, but do not necessarily establish its field of operation.

Speed or Time Requirements.

The normal speed in miles per hour of the electric truck in its usual sizes is: One-half-ton, 13; one-ton, 10½; two-ton, 9; three and one-half-ton, 8; five-ton, 7. These may seem slow compared to the possible speed of the gasoline truck on a straightaway piece of road, but low speed is one of the strongest points in favor of the electric for much trucking work.

It costs money to drive a heavy motor truck with solid tires under all conditions, and when we remember that the force of a blow struck by a moving object varies directly with the weight of the object and with the square of its velocity, we can realize that a little increase in speed affects the wear and tear on a truck considerably. Furthermore, the electric truck speeds are very nearly the maximum which can be safely used in congested city conditions, and as the electric is more flexible to handle in stopping, starting, threading through traffic, and getting in position to load and unload, it will travel about the same number of miles per day in ordinary city trucking as the gasoline truck when the latter is safely handled. There is also the advantage that the speed of the electric truck is predetermined and cannot be increased to 30 miles per hour or so at the will of an irresponsible driver when he is beyond your immediate jurisdiction. High speed, with its attendant danger, depreciation and repairs, as it exists in the gasoline truck, is not warranted in most trucking conditions where goods are to be hauled cheaply and not on express schedules. Unless your particular problem demands speed regardless of expense, the electric has all the speed consistent with economy.

Garaging Care.

There is nothing mysterious about the power mechanism of an electric truck, any more than there is about the electric battery that rings your door bell and the electric motor and controller that propels your street cars under the guidance of a motorman who knows little about the theory of electricity and with little experience in its application.

There are certain attentions necessary to keep an electric truck in the pink of condition, but they are not more difficult to learn than the theory and practice of feeding and watering a horse, keeping him shod and groomed —in fact, any intelligent driver interested in his work can keep his electric truck in better shape with less effort than he can a span of horses, wagon, harness, blankets, etc.

Every manufacturer from whom an electric truck is purchased will gladly advise fully as to its care, and furnish a factory expert to assist in its installation. So long as electric current for lights or power is available, the electric truck may be readily charged.

The Cost of Operation.

It is comparatively simple to compute the cost of operation when the local conditions are known, such as the cost of electricity, the size and type of battery required, etc. In general terms a comparison of operating cost between an electric and gasoline truck of the same load capacity traveling the same number of miles per day is given below:

Driver:—$156 per year, as a mechanic is not required to operate and care for an electric, or a difference in wages between $15 and $18 per week.

Tire wear:—About evens up with the gasoline. Electric tires wear longer owing to the slower speed, but cost a little more bwing to the more resilient qualities necessary to propel the truck with the least power.

Battery wear and charging current:—These items should be considered as

fuel cost and will vary with the cost of current and size and type of battery. If current cost is assumed at three cents per kilowatt-hour and figures computed for the "Exide Ironclad" battery as an average equipment. the daily costs will be approximately as follows: 1,000-pound truck, $1.03; 2,000-pound truck, $1.25; 4,000-pound truck, $1.47; 7,000-pound truck, $1.93. With gasoline at 17 cents per gallon, the daily cost of fuel and engine lubricating oil will be approximately: 1,000-pound truck, $0.65; 2,000-pound truck, $0.85; 4,000-pound truck, $1.00; 7,000-pound truck, $1.40. These figures show that the gasoline truck fuel and oil cost over one-half as much as the combined cost of battery wear and charging current for the electric.

Repair Parts, Labor and Depreciation.—As we have already provided for battery wear we have left in the case of the electric a very simple mechanism which is sturdy and naturally requires very little in the way of repair parts and labor to keep it in excellent operating condition.

In addition to these simple parts, such as axles, springs, frame, etc., which are similar in construction in both electric and gasoline trucks, we have in the gas truck a complicated reciprocating gas engine with all the attendant troubles, a train of clash gears or transmission, clutch, gear shifting devices, etc. The repairs, of course, are very much higher for the gasoline truck, and its efficient life is about one-half that of the electric or five years against ten. Assuming the initial cost the same for the two types, we have the following comparison for the different sizes:

REPAIR AND DEPRECIATION PER YEAR.

Size	Electric	Gasoline	Difference in Favor of Electric
1000 pound	$1349	$1731	$382
2000 pound	1455	1891	436
4000 pound	1611	2136	525
7000 pound	1854	2486	632

Assuming interest on the investment, insurance, storage, painting, etc., the same for either type, a summary of the above figures on a yearly basis of 300 working days per year shows the following results:

Size	Electric	Gasoline
1000 pound	$260	$ 600
2000 pound	300	700
4000 pound	390	900
7000 pound	495	1130

In addition to this saving in operating cost you obtain more continuous service with the electric. There are no valves to grind, carbon to remove, ignition and carburetor to repair, and similar attentions which keep the truck out of commission several days a year. The electric is simple in construction, simple to operate and always on the job with a minimum expense. It is adapted to the trucking requirements of at least 85 per cent of all lines of business and in these cases will operate at an economy to the owner.

Comparison of the Silver and Iodine Voltameters.

A form of iodine voltameter was devised by Washburn and Bates and was found to be of about the same order of reproducibility as the silver voltameter. Because of the reversibility of the reactions taking place at the anode and the cathode and the character of the deposit, which precluded the possibility of inclusions of foreign material, it seemed a desirable instrument to use in the determination of the electrochemical equivalents, especially since the values for these constants had heretofore been based on the silver measurements alone.

Accordingly arrangements were made for a comparison of the silver and iodine voltameters at the Bureau of Standards during the summer of 1913, by G. W. Vinal and S. J. Bates, and the results will shortly appear in the *Bulletin* of the Bureau. The operation of the iodine voltameters was in general the same as previously described by Washburn and Bates. The silver voltameters were of the porous-cup and Smith form, following the usual procedure of the Bureau of Standards. Since the same current passed through the silver and iodine voltameters, the ratio of silver to iodine may be immediately calculated. As a result of ten experiments, in each of which several voltameters of both types were employed, the ratio Silver/Iodine = 0.85017 was found. This is slightly higher than the ratio (0.84998) ascribed to atomic weights. All sources of error have been carefully examined and are critically discussed in the full paper. None, however, are believed to be sufficient to account for the difference between this value and the ratio of the accepted atomic weights.

Using the results of the silver voltameter to measure the coulombs passing through the circuit according to the decision of the London Electrical Conference (1.11800 milligrams of silver = 1 coulomb) the electrochemical equivalent of iodine is 1.31502 milligrams per coulomb.

The value of the faraday on the basis of the present international atomic weight of iodine (126.92) and the foregoing value of the electrochemical equivalent of iodine is:

$$\frac{126.92}{0.00131502} = 96{,}515 \text{ coulombs.}$$

The value of the faraday derived from atomic weight of silver and the defined electrochemical equivalent of silver is:

$$\frac{107.88}{0.00111800} = 96{,}494.$$

The mean value of the two is 96,504, but the authors recommend for general use that the round number 96,500 be used.

BOOK REVIEW.

"Resuscitation." By Charles A. Lauffer. New York: John Wiley & Sons. Cloth, 47 pages (4x6½ inches), illustrated. Supplied by the Electrical Review Publishing Company for 50 cents.

The author of this volume is medical director of the Westinghouse Electric & Manufacturing Company and has given much consideration to resuscitation from electric shock. This volume describes the mechanism of respiration and explains the application of the Schaefer prone-pressure method of resuscitation, which is applicable not only in cases of electric shock, but in drowning, asphyxiation and, in fact, in every case of suspended respiration. The material is placed in small compass and should be read by every electrical worker who is not already familiar with this subject. As the author points out, life can be saved in nearly every instance of suspended respiration if the proper means are instituted without delay. The following is a quotation from the foreword: "Complete details of how to rescue a comrade from a dangerous situation must be thought out in advance; the location of switches, and modes of short-circuiting lines, and of separating a body from an electrical contact without danger to the rescuer, must be studied out in advance by the individuals of each department of electrical service. With adequate circumspection and forethought, fatalities can be much reduced. And when these apparent calamities do occur, consternation seizes especially those not adequately trained to cope with the responsibilities of the situation. Artificial respiration should be practiced by everybody, in anticipation of any such emergency."

Steam Regenerator Patents Sustained.

Judge Hand, of the United States District Court, Southern District of New York, in his decision of January 14, 1914, in the suit brought by the Rateau Steam Regenerator Company against the American Regenerator Company, held Rateau patents Nos. 679,242 and 12.295 valid and infringed.

Radium Illuminates Sign in Colorado.

According to newspaper reports radium spelled in its own fire furnishes an illuminated sign which is to be used to exploit Colorado's mineral resources. The sign contains the single word "Radium" and is said to be made self-illuminating by the use of an infinitesimal fraction of specially treated radium.

New Electrical and Mechanical Appliances

Pressed-Steel Case for Distributing Transformers.

A new and radically different type of transformer case for distributing transformers has been developed, illustrations of which are shown herewith. This new case is of pressed steel, replacing the ordinary cast-iron cases which have been in general use for the past 25 years. The material used is blue-annealed planished steel plates.

The principal advantages claimed for the new pressed-steel case are that it is much lighter and stronger than the ordinary cast-iron cases.

The reduction in weight of transformers is important to the central-station, because the cost of handling transformers is a definite appreciable item of expense to which little attention has been paid heretofore, probably because there was no escape from the bulk and weight of distributing transformers, since all manufacturers were confined to the use of heavy cast-iron cases.

Distributing Transformer with Pressed-Steel Case.

Another View of Pressed-Steel Transformer Case.

When considering the handling expense, transformers are really a tonnage material, the lightest and smallest size weighing at least 100 pounds, and the medium and larger sizes weighing up to 3,000 pounds each, for the pole-type sizes. The handling of distributing transformers is necessarily done by the line crew with hand power and man power, which is much higher in cost than mechanical horsepower; consequently installation cost is reduced by the lighter transformers.

Saving in the cost of freight is easily seen because it can be definitely shown by figures. An average saving in the total transformer weight of 30 per cent claimed by the manufacturers of the new pressed-steel case transformer, means practically an average saving of 30 per cent in freight, and since transformers run into considerable weight, the cost for freight is a considerable item of expense, which the buyer of distributing transformers must pay directly or indirectly.

While it is difficult to get accurate central-station costs for the handling of such heavy material as transformers, fairly close estimates are made and such estimates show that on 10,000 pounds of transformers shipped 500 miles, the freight, cartage, loading, unloading, warehousing, installing, etc., costs about $110. Thus, a 30 per cent decrease in weight saves $33.

This percentage of weight reduction is substantial enough to result in other practical benefits to the central station in permitting larger transformers to be mounted on poles with the same pole-strain safety factor, or it permits the use of smaller poles for given transformer sizes.

Reduction in weight with the additional advantage of strength is, of course, very desirable. It is claimed that the new pressed-steel case has been developed not only lighter in weight, but much stronger than cast iron, so that the new case will stand up even better to the everyday wear and tear, rough handling in transit, accidental bumps and jars, such as sometimes happen when a transformer is dropped from a pole or wagon.

Tests were made by a prominent laboratory, it is stated, where 13 blows with a sledge failed to show any injury, except slight indentation of the pressed steel, whereas two blows of the sledge applied to an ordinary cast-iron case cracked the case with the first blow and completely shattered it with the second blow.

It is known that the common cast-iron case will leak oil, due to seepage through the porous cast iron unless it is carefully japanned, and where the cast iron is imperfect or thin, hot transformer oil will seep through the metal and drip. Pressed steel, due to its density and non-porous structure, eliminates the possibility of oil seepage.

The new pressed-steel case has been under development for several years and it is stated actual tests in service have been thoroughly carried out by its originators, the Pittsburgh Transformer Company, Pittsburgh, Pa.

Electric Radiator for Warming Automobiles.

Much trouble is usually experienced in winter by automobilists in trying to start the engine of a gasoline car that has been allowed to become chilled. Another difficulty is the liability of the water in the radiator freezing; this has necessitated draining the radiator at night and refilling in the morning.

Electric Heater for Gasoline Automobiles.

In order to overcome these objectionable features, there has been developed a compact electric radiator or heater that can be placed into the hood of the car at night to keep the entire engine warm. This radiator measures only 6 by 7 by 0.5 inch and weighs but two pounds; thus it is eas-

ily handled and used in the hood. The energy consumption of the radiator is small, so that it can readily be connected through flexible cord and attachment plug to any standard lighting outlet in the garage. The radiator furnishes enough heat to keep the engine sufficiently warm to enable it to be started readily.

The radiator has a Dubilier electric heating unit mounted between Electrobestos strips. This is protected by perforated metal sheeting. The construction is such that the element cannot burn out if used on circuits of proper voltage. The radiating surface is so disposed as to make a very efficient heater.

It has been found that by using this radiator the engine can be started almost invariably at the first turn of the crank or first push of the starting button, whether the car has stood idle for a few hours, all night or for several days. It keeps the carbureter and other engine parts in prime condition.

These electric heaters are made by the Dubilier Electric Company, 63 Fifth Avenue, New York City.

Universal Safety Manhole Guard.

The increasing amount of underground conduit installed in streets with congested traffic has called for some simple and reliable manhole guard to prevent accidents when manholes are opened for cable splicing or other work. Such a guard should be easily transported, readily set up and be of such construction that it will not collapse on slight pretext.

To meet these requirements there has been placed on the market a durable and reliable manhole guard that

Fig. 1.—Manhole Guard Folded.

is made of steel and iron, readily folded for shipment and opened for use, and when opened remains so because of interlock features. The outfit is entirely self-contained and has no loose parts to become misplaced or lost.

Fig. 1 shows the outfit folded up for convenient shipment or storage. In this condition it occupies a floor space of 38 by 8 inches. Its weight is 50 pounds, sufficient to hold it in place in service and yet permitting it to be easily picked up and carried by a workman. Fig. 2 shows the guard viewed from the side when partly opened. The guard in service is shown in Fig. 3.

The guard consists of a one-piece channel-steel top circle, a two-part angle-steel bottom circle and five connecting legs. The latter and the connecting hinge parts and sleeves are made of malleable iron. All joints are securely riveted; the entire construction is therefore exceptionally strong. The two side legs and the rear leg are hinged to both top and bottom rings; the two front legs are hinged to the top ring only near the ends that constitute the opening to give access to the manhole.

To open the guard, the front part of the lower ring is first swung down and then the rear part thereof, together with the upper ring which is connected thereto by the rear leg, is swung into place. This is shown by

Fig. 2.—Guard Partly Opened.

Fig. 2. When both rings are in place, the front legs are swung down and sleeves on their lower ends are slipped over corresponding lugs on the

Fig. 3.—Guard Fully Opened.

bottom ring. The guard is thus locked in the service position, Fig. 3. To close up the guard, the sleeves at the bottom of the front legs are first lifted and the folding follows the reverse order of opening.

The guard is of ample size for any type of underground manhole. When in service position, its inside diameter is 36 inches and its full height is 33 inches.

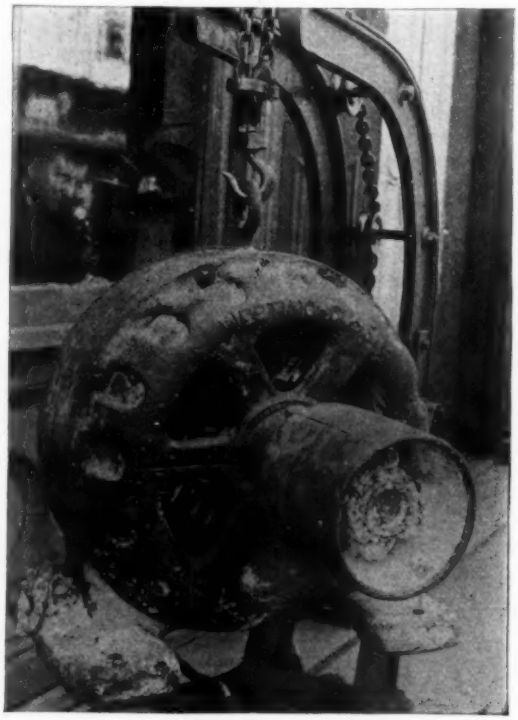
These guards are manufactured by the Universal Cable Grip Company, Syracuse, N. Y.

Underground Cable Proves Valuable.

During the recent severe storms in the East, especially in New Jersey, when nearly all overhead telephone and telegraph lines were down, the underground cables of the American Telephone & Telegraph Company, between Boston and New York and between New York and Washington proved of incalculable service in providing the only reliable means of communication through the affected district.

Induction Motor Withstands Severe, Continuous Service in Salt Mine.

The accompanying view shows a Westinghouse induction motor which was recently removed from the mine of the Myles Salt Company on Avery Island,



Induction Motor Removed from Salt Mine After Six Years' Use.

La., and sent in to be rewound, the motor having burned out after six years' continuous service.

The very heavy incrustations of salt should be noticed in the pulley, around the terminals, and especially on the rotor fans and stator windings. Needless to say, a good deal of this salt was shaken off during transit, but in view of the water-absorbing quality of rock salt, there is sufficient remaining to make a very striking demonstration of the severe conditions that the motor withstood successfully so long.

New Starting Switch for Induction Motors.

A new switch has been designed for throwing small squirrel-cage induction motors directly on the line. The shaft carrying the switch contacts extends through both sides of the inclosing case, the lever for its operation being attached to the right end, while a locking arm is attached to the left end.

The operating lever is held in the "off" position by strong springs and the design of the switch mechanism is such that the lever cannot be thrown to the running position until it has been thrown to the starting position, thus rendering it foolproof.

The switch contacts are oil-immersed, thus utilizing the oil break to minimize sparking and insure long life. The oil tank is so designed that it takes but a moment to remove it, if one desires to inspect or repair the switch.

This type of switch is provided with a low-voltage-release coil which shuts the motor down in case of failure of voltage. The magnet coil being de-energized, its core drops, striking the lever which engages with the locking arm so as to hold the switch closed in the running position, thus tripping the switch and permitting the starting lever to return instantly to the "off" position. The low-voltage-release coil is totally inclosed so that it cannot be injured in handling or affected by foreign substances.

Overload relays, so designed as to permit of a wide range of adjustment, protect the motor from overloads and prevent it running single phase. The relays are mounted within the inclosing case.

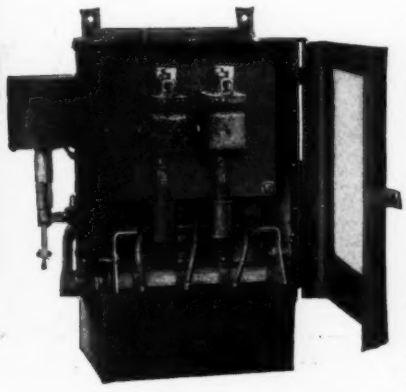
If it is desired to stop the motor from remote points, push-button stations may be wired into the low-voltage-release circuit so that when the button is pressed this circuit is opened and the switch tripped in the same manner as when the voltage fails.

This starting switch is totally inclosed and is arranged for conduit wiring, the conduit entering the top of the case so that the leads may be brought down inside the case and all connections be concealed. The front of the case is closed by a hinged cover provided with a snap catch to permit of easy inspection of coils and connections.

To start, the operator moves the starting lever away from him to the limit of its travel, throwing the motor directly on the line. After the motor has come up to speed, he pulls the lever towards himself to the running position, cutting the overload relays into the circuit. Thus these relays are not in circuit while starting, which permits their being set for operation just above the full-load current of the motor, if desired.

This switch is designed for use with squirrel-cage induction motors of capacities up to and including 7.5 horsepower, for potentials of 110, 220, 440, and 550 volts, and frequencies of 60, 40, and 25 cycles, two and three phase.

Starting Switch for Induction Motor.



Switch Opened for Inspection.

This motor-starting switch is manufactured by the General Electric Company, Schenectady, N. Y.

Electric Vehicles at Boston Automobile Show.

Seven makes of electric automobiles were exhibited at the Boston 1914 Automobile Show, whose pleasure-car exhibition opened in the Mechanics Building March 7 and continued through the past week. The attendance on the opening night numbered about 50,000. A bulletin of exhibitors, illuminated by means of an electric lighted reflector, occupied a position near the main entrance. The decorations of the halls were elaborated and included Venetian scenes and floral embellishments. The names of the exhibitors were announced at each exhibit by round glass globes suitably inscribed with gilt lettering and enclosing ruby electric lamps.

The Anderson Electric Car Company, makers of the Detroit Electric, showed a five-passenger brougham with duplex drive, and a four-passenger brougham. There was also a two-passenger roadster. Forty-two-cell lead or 54-cell Edison batteries are employed in this company's cars. The five-passenger car is lighted inside by two 20-watt lamps, inclosed in ground glass globes, located in the upper back corners of the body. An automatically operated switch in the door frame lights the lamp as the door is opened to admit passengers.

S. R. Bailey & Company, Amesbury, Mass., showed a four-passenger roadster, a new cabriolet or convertible roadster accommodating two persons, and a two-passenger standard roadster. The cabriolet is equipped with a detachable top with wood-framed side window and folding wind shields which enable the car to be used as an open car in summer and an enclosed car in winter. The four-passenger Bailey is equipped with 60 cells A-6 Edison battery. These cars are designed for a 25 miles per hour running speed, and run 70 to 100 miles on a charge.

The Waverley electrics exhibited by the J. W. Bowman Company included a special "gold car," a four-passenger brougham with elaborate upholstery in cloth of gold, and an exterior specially gilded for the exhibition. There was also a four-passenger dual-drive brougham, operated from either front or rear seat, and a five-passenger forward-drive brougham. The batteries used are optional with the purchaser.

The Peerless Motor Car Company exhibited a four-passenger Rauch & Lang brougham having two separate drives for operation from the forward or rear seats.

The Ohio Electric Car shown by the D. C. Tiffany Company was a four-passenger rear-drive car, and there was also a chassis showing motor equipment and running gear.

The Century Electric Car Company exhibited a four-passenger brougham and a five-passenger car of the same type with especially spacious interior. Willard batteries, especially manufactured for the company, are used.

The following manufacturers of accessories exhibited their specialties: American Storage Battery Company, Burn-Boston Battery & Manufacturing Company, Forest City Electric Company, Holtzer-Cabot Electric Company, Philadelphia Storage Battery Company, Van Dorn Electric Tool Company.

The electrical equipment of the gasoline cars was notable. Electric lights and starting apparatus were all but universal and in several cars electric gear-changing apparatus is employed and the electric brake is also demonstrated as a practical feature. Electrically operated horns, headlights and interior lights were in increasing evidence.

The commercial division of the show will occupy the coming week.

A Typical Up-To-Date Central-Station Standby Storage Battery.

The Indianapolis Light & Heat Company, of Indianapolis, Ind., has recently completed the installation of an emergency storage battery consisting of 156 type H-61 Exide cells. This battery has a capacity of 4,500 amperes for one hour, or 9,300 amperes for 20 minutes. It is installed with 78 cells on each side of the neutral of the three-wire system, of which 22 cells on each side are connected as end cells. Fig. 1 shows a view of the interior of the battery room.

This battery installation is up-to-date in every respect. The cells are mounted on the latest type of oil insulation. There are four remote-control motor-driven end-cell switches, two on each side of the system, each having a continuous capacity of 5,000 amperes with an overload capacity sufficient to carry any output which the battery can give. The two switches on each side may be operated in parallel, if desired, by interlocking their driving mechanism, in which case the two operating motors are connected in parallel. Each motor has, however, sufficient capacity to operate both switches, if necessary.

The 22 end cells on each side of the system are connected to the points on the end-cell switch by heavy lead-coated copper conductors. Each cell switch has 12 points and the 22 cells on each side of the system are connected to the two corresponding end-cell switches in four three-cell groups, three two-cell groups and four single cells. The single end cells are located next to the main battery, permitting adjustment of the floating point within the ordinary range of bus voltage variation. During an emergency discharge the extreme end cells are thus cut in two and three cells at a time as the voltage of the battery drops. The switches travel from point to point at high speed, and it is possible to move the traveling brush from one end to the other, thus cutting in all of the cells of the battery, in fifteen seconds.

The battery is equipped with the latest type of automatic pilot-cell-filling devices and recording and signaling hydrometers, one outfit on each side of the system. The hydrometers give a graphic record of the specific gravity of the two pilot cells corrected for variations of temperature, while the cell-filling devices maintain the level of the electrolyte in these pilot cells at a constant point, thus eliminating errors in the specific-gravity record due to evaporation. The hydrometers may also be set to give a signal when the specific gravity of the pilot cell reaches any predetermined value, either at the upper or the lower end of its range, thus warning the operator when the battery is sufficiently charged, or when it reaches a certain state of discharge.

The switchboard equipment for the control of the battery consists of eight panels of black oiled slate, occupying a total length of 10 feet 8 inches with a height of 7 feet 6 inches. On this switchboard in addition to the knife switches for connecting the end-cell switches to the bus and the usual indicating instruments there is installed for each end-cell switch the Electric Storage Battery Company's recently developed indicating control switch. This switch is designed to control the operation of the end-cell switches, and at the same time indicate this operation. It is possible by a single turn to set this control switch to indicate the point to which it is desired to adjust the corresponding end-cell switch, and the latter will then travel to the desired point without further attention on the part of the operator. The setting of this control switch is accomplished by turning a small hand wheel which brings to view behind an opening in the dial the number of the end cell to which it is desired that the end-cell switch shall travel. While the end-cell switch brush is in motion, as a result of this setting, the exposed number is illuminated by an intermittent colored light, the color being red if cells are being cut in and green if cells are being cut out. As soon as the cell switch arrives at the desired point, it will stop automatically and the illumination becomes a steady white light.

This battery installation is installed at Substation C, which is equipped with one motor-generator set for receiving alternating current and delivering direct current to the 240-volt bus. This motor-generator set has a capacity of 1000 kilowatts. The motor is of the three-phase induction type. The neutral point of the battery is connected to the neutral of the system, but no other neutral is provided at this substation, the motor-generator set being connected directly across the outside wires at 240 volts.

For charging the battery there is installed a three-unit booster set consisting of a synchronous motor driving two direct-current generators.

In addition to this battery the Indianapolis Light & Heat Company has in service another battery consisting of 156 cells type H-59 Chloride Accumulator, which has been in service since January, 1901, or approximately 13 years. Its capacity is 9,000 amperes on each side of the neutral for 18 minutes. The combined capacity of these two batteries is sufficient to carry the total peak load for approximately 18 minutes. Fig. 2 shows a picture of the old battery room.

Both of these batteries and appurtenances were manufactured and installed by the Electric Storage Battery Company, Philadelphia, Pa.

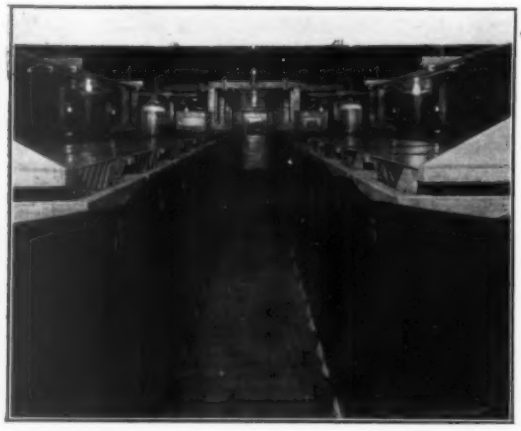


Fig. 1.—New Standby Battery for Indianapolis Plant.

Fig. 2.—Old Battery Installation for Same System.

Franklin Electric Manufacturing Company Completes New Middletown Factory.

The Franklin Electric Manufacturing Company has completed factory "B" at Middletown, Conn. The company's factory floor space now totals approximately 133,500 square feet, all of which is devoted to the manufacture of incandescent lamps. The three

Three Factory Plants of Franklin Electric Manufacturing Company.

illustrations herewith show, respectively, the Middletown factory "B," the Hartford factory, and the Middletown factory "A." The latter or new plant contains 66,500 square feet; factory "B" at Middletown, contains 22,000 feet; the Hartford plant contains 45,000 feet.

An item in a recent issue of this publication stated that the company was about to increase the capacity of its "Woodbine Street factory by the addition of another story, making the building of three stories, 62 by 34 feet." This statement should be corrected, as it would lead one to believe that the incandescent lamp factory at Hartford was meant. The building referred to is utilized entirely for office purposes and is separate and distinct from the factory buildings, and the floor space involved is not included in the figures mentioned above.

An Electrically Driven Southern Brick Plant.

The brick plant of L. I. Stevenson, located about 12 miles from Birmingham, Ala., on the Central of Georgia and Southern railroads, represents everything modern and efficient in equipment and layout. All the machinery is motor-driven, the power is purchased from the Alabama Power Company, and the kilns are operated on the waste-heat system. These several features represent the latest practice in brick-plant operation and have proved in many installations their economy over other methods.

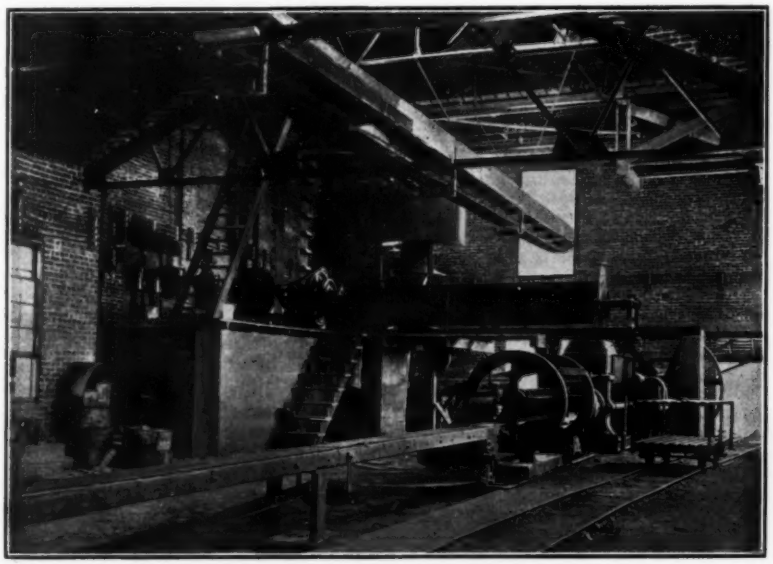
This plant has a capacity of 10,000 brick per hour, the product being red-shale common and Oriental brick, the latter resembling a tapestry brick with a rough wire-cut surface. The brick may be burned any shade from light red to almost black.

Shale is mined at a point several hundred feet from the plant and hauled by cars which are pulled up the slope by a 50-horsepower motor. The shale is first sent to a crusher, driven by a 30-horsepower motor and is then passed through either pulverizers or dry pans, depending on its condition. A tripper conveyor then distributes the material over a 100-foot storage space.

The pug mill is driven by a 50-horsepower motor and the combination brick machine by a 125-horsepower motor. The illustration herewith shows these two machines and illustrates the simplicity of motor-driven machinery and the flexibility with which it can be located to suit the sequence of operations.

An electrically driven transfer car conveys the brick from the dryer to the kilns, of which there are 16, each of 70,000 brick capacity. Three motor-driven fans are used to provide draft, circulation, and exhaust for the kilns.

Power is received at 22,000 volts and is stepped down to 550 volts for the use of the motors, and to 110 volts for the incandescent and arc lamps. A two-panel switchboard equipped with oil circuit-breakers protects and controls the various circuits. The electrical equipment, except the hoist motor and transfer car, was supplied by the Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.



View in Electrically Driven Brick Plant.

Low-Voltage Sparks Not Responsible for Mine Explosion..

During the British government inquiry as to the cause of the explosion at Senghenydd, South Wales, on Octover 14, 1913, in which over 400 lives were lost, it had been suggested that the explosion of gas was caused by an electric spark from the bell or signaling wires. To test this theory careful experiments were made, under official supervision, and the results of these experiments are held to prove that the intensity of sparks at nine volts (the voltage employed in the mine where the explosion occurred) could not ignite an explosive atmosphere. Mine gas, containing over 95 per cent methane, was used in the experiments.

International Electrical Exhibition in Spain.

The definite announcement has been made that an International Exhibition of Electrical Industries will be held in Barcelona, Spain, in the year 1915. It is considered that the undertaking will not only be of importance for Spain but for all other participating countries as well. A strong managing committee has been named and an initial credit of 10,000,000 pesetas ($1,800,000) has already been voted in order to defray the expenses of the exhibition, which is intended to be really international in its scope. Correspondence in reference to the matter should be addressed in Spanish to the Alcalde of Barcelona, who is at the same time president of the committee in charge of the arrangements.

The use of the telephone is slowly increasing in China, particularly where foreigners reside.

An Improved File Handle.

In order to make a more durable tool and also one less liable to cause injury to the workman, there has been devised an improved form of file handle which is manufactured by the W. T. Nicholson & Clipper Company, King Street, Salford, Manchester, England. The accompanying illustration shows the construction. Pressed into the handle is a flanged steel tube which is driven into the end of the wood into which the file is to be inserted. The flange of the tube overlaps the ferrule. It is tapered in order to fit snugly over the ferrule.

By using the tube splitting of the wood is prevented when the file is driven in and the ferrule is also prevented from coming off. By compressing the wood, the file is held much tighter than in an ordinary handle. Danger of the tang running into the workman's hand is also eliminated.

File Handle with Internal Steel Tube for Durability and Safety.

Annual Salesmen's Convention of the National Carbon Company.

The eighth annual salesmen's convention of the National Carbon Company was held in Cleveland, O. during the week of February 23. About 120 employees were present at the banquet on Thursday night at the Hollenden Hotel.

High-speed wireless tests recently held at the Clifden, Ireland, station, are said to have resulted in the transmission of 145 words per minute, a new record in wireless telegraphy.

Latest Approved Fittings

The electrical fittings illustrated and described in this department have been approved by the Underwriters' Laboratories, Incorporated, following examination and tests conducted under standards of the National Electrical Code as recommended by the National Fire Protection Association.

CIRCUIT BREAKERS.—Roller-Smith Company, 203 Broadway, New York, N. Y.

"Standard" and "Industrial" styles, 600 volts and less.

Approved January 23, 1914.

FIXTURES.—Mercantile Advertising Company, Marbridge Building, New York, N. Y.

"Midas" interchangeable electric letters. Special receptacles with plug contacts for 10-watt incandescent lamps and with small glass and metal lanterns inclosing each lamp, together with a special frame for mounting these receptacles and provided with armored cord and an attachment plug.

Approved February 16, 1914.

FLEXIBLE CORD.—Simplex Wire & Cable Company, 201 Devonshire Street, Boston, Mass.

Marking: one red cotton thread or two red cotton threads under braid and parallel to the wire.

Cords shown by tests and examinations conducted by Underwriters' Laboratories to be in accordance with requirements of the National Board of Fire Underwriters and examined at factories and passed by Underwriters' Laboratories, have labels attached to each coil.

Approved February 11, 1914.

RECEPTACLES, Standard.—Harvey Hubbell, Incorporated, Bridgeport, Conn.

"Hubbell" brass-shell wall sockets.

Key, "Lock Shell," catalog Nos. 3,545, 3,546, 3,719, 3,721, 3,723.

"Quick Catch," catalog Nos. 3,732, 3,735, 3,747, 3,751, 3,752.

Pull, "Lock Shell," catalog Nos. 3,832-34 inclusive, 35,021; also 3,835 for use on metal ceilings.

"Quick Catch," catalog Nos. 3,838-40 inclusive; also 3,841 for use on metal ceilings.

Approved February 10, 1914.

RECEPTACLES, Standard.—Pass & Seymour, Incorporated, Solvay, N. Y.

"P. & S." brass-shell, closed or slotted bases.

Pull, 250 watts, 250 volts.

Conduit box, 428.

Also the above types with shadeholders attached; key type with composition or insulated metal key, or with "Shurlok" attachment.

Approved February 10, 1914.

RECEPTACLES, Standard.—The Perkins Electric Switch Manufacturing Company, Bridgeport, Conn.

"Perkins" brass-shell wall sockets (slotted or closed bases).

Key, 250 watts, 250 volts; catalog Nos. "New Wrinkle" 4,554 and 7,554 for use on metal ceilings.

Keyless, catalog No. "New Wrinkle" 7,555 for use on metal ceilings.

Also all the above types with shadeholders attached; key types with composition or insulated metal key.

Approved February 6, 1914.

RHEOSTATS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

"C-H" all capacities, 115, 230 and 500 volts.

Resistance plates, iron-clad; bulletin No. 1,250.

Approved February 10, 1914.

RHEOSTATS.—The Cutler-Hammer Manufacturing Company, Milwaukee, Wis.

Direct-current self starters; bulletin Nos. 3,500, 4,400, 4,410 with speed regulators, 0.25 to 20 horsepower; 6,090, with knife switch and fuses; 6,250, 20 to 200 horsepower.

Approved February 10, 1914.

RHEOSTATS.—Westinghouse Electric & Manufacturing Company, East Pittsburgh, Pa.

125 to 650 volts. All capacities.

Motor starter; Type DM.

Resistance unit; Type DE.

The rheostats known as Type DM are approved only when circuit-breakers or fuses are installed in connection with them as required by Rule 78*g* of the National Electrical Code.

Approved February 6, 1914.

SOCKETS, Standard. — C. S. Knowles, 138 Suffolk Street, Chelsea, Mass.

"Zee" sockets, 660 watts, 250 volts.

Key; catalog Nos. 650 and 750.

Keyless; catalog Nos. 601, 651, 701 and 751.

Approved February 10, 1914.

SOCKETS, Weatherproof. — The Brayant Electric Company, Bridgeport, Conn.

"Bryant" 1,500 watts, 600 volts, mogul base.

Porcelain shell; catalog Nos. 4,069-4,071 inclusive.

Standard for use with incandescent lamps in series on 600-volt circuits.

Approved February 10, 1914.

SWITCHES, Automatic.—Victor G. Jensen, 657 East Sixty-third Street, Chicago, Ill.

"Commonsense" time switch, 30 amperes, 125 volts.

A time switch consisting of an alarm clock and a standard double-pole knife switch mounted in an approved metal cabinet.

Approved February 16, 1914.

SWITCHES, Surface Snap.—The Trumbull Electric Manufacturing Company, Plainville, Conn.

Lock attachment, catalog No. 398 and key.

Approved February 17, 1914.

Current Electrical News

LIGHTING AND POWER.

(Special Correspondence.)

HARTLAND, MINN.—An electric light plant will be erected here to cost $3,000. C.

PLYMOUTH, IOWA.—The council is planning ways and means to secure electric lighting.

MILTON, ORE.—The Council plans to improve the electric plant. Address the city clerk.

JANESVILLE, MINN.—A movement is on foot to install ornamental lighting on Main street. C.

BEVIER, MO.—At a special election the proposition of a municipal lighting plant carried by a big majority. M.

WINONA, MINN.—George Hirsh is chairman of a committee that will install ornamental electric street lighting in this place. C.

ANAMOSA, IOWA.—Business men will install an ornamental lighting system on the principal business streets of Anamosa. C.

HUNTINGTON, IND.—The Council plans to enlarge the present electric light plant. Address City Attorney F. H. Bower.

HELENA, MONT.—A $30,000 lighting system will be established in the west side. Address Mayor Purchell for particulars.

OMAHA, NEB.—A municipal electric lighting plant will be established. Address R. B. Howell of the Metropolitan Water district.

OLD BRIDGE, N. J.—The Trustees of South Old Bridge are considering the installation of new arc lamps along the main thoroughfare. A.

SUMNER, MO.—A franchise has been granted to a syndicate to build an electric light and power plant. Address the city clerk for particulars.

PRINCETON, N. J.—The Lighting Committee of the City Council is arranging for the installation of additional street lights; incandescent lamps are now used. A.

HOLDINGFORD, MINN.—The Holdingford Milling Company made a proposition to install a lighting and power plant. Address Alex Lemmer for further information.

DEERFIELD, WIS.—A company has been organized with a capital stock of $50,000 to furnish electricity to this place. O. A. Oestrich and I. A. Avery are the incorporators.

ABBEVILLE, LA.—It has been decided to improve the city power plant. Harold Raymond, of New Orleans, is preparing specifications. The contemplated cost is $25,000.

GOOD THUNDER, MINN.—The Commercial Club is planning to install an electric light plant here. Address A. W. Seaquist, president of the Commercial Club, in regard thereto.

WAUCOMA, IOWA.—The water power owned by Robert Twamley will be purchased by the city, and $12,000 will be expended installing a lighting plant. Address the city clerk for particulars.

EDMONTON, KY.—The Edmonton Light & Power Company has been incorporated with a capital stock of $1,250 by George Greenup, S. W. Free, A. B. Thompson, J. L. Dillon and W. E. Vansant.

ALAMOGORDO, N. M.—The Alamogordo Water Works Company is preparing to erect a new power plant which will supply current to operate all the irrigation pumping plants of the Alamogordo Valley. D.

MARYVILLE, TENN.—The Aluminum Company of America, with general offices in Pittsburgh, will built its own power plant, it is reported, erecting a hydroelectric plant on the Little Tennessee River in Blount county. G.

CITY OF MEXICO, MEX.—The Federal Government has granted a concession to Jacinto Barrera and Salvador Luque for the use of the waters of the Tonantongo River, state of Hidalgo, for the generation of electrical energy. D.

SHEBOYGAN, WIS.—The Council is again considering establishing a municipal light system. The company now furnishing lights will expend $15,000 if the contract is renewed. Address Edward Hammett, general manager.

METTER, GA.—The Metter Co-operative Light & Power Company has been organized here with a capital stock of $20,000 and will establish and operate an electric light plant here. The incorporators are J. R. Dixon, W. J. Brown and others.

KENT, O.—A thorough investigation of municipal ownership of lighting plants throughout Ohio is being made by Mayor M. L. Davy, with the view of making recommendation to the Council that a municipal plant shall be installed here. J.

BALFOUR, N. D.—The Village Council here has granted a franchise to Schimel Brothers, owners of the Balfour mill, giving them the right to install and operate an electric light plant. The franchise provides that the plant must be installed by May 1.

TUSKEGEE, ALA.—The installation of a new water distribution system and an electrical system at the Tuskegee Normal and Industrial Institute was authorized by the Board of Trustees. Work will begin this spring. Address the Secretary of the Board.

MONTPELIER, VT.—Bread Loaf Mountain Power Company has been incorporated with a capital stock of $5,000. The company will develop electric energy and sell the same for light and power from Middlebury River and its branches and the Lamoille River.

BIRMINGHAM, ALA.—The Birmingham-Tuscaloosa Railway & Utilities Company is reported as issuing $600,000 bonds to build a central generating station and gas holder at Tuscaloosa, Ala., to extend gas distributing system and electrify and extend its steam railway.

CORDOVA, ALASKA.—City Council has under consideration the application of H. H. Knox for a franchise to install and operate an electric light and power plant in this city, and if same is granted, which is probable, work of construction will begin at an early date. O.

MERCHANTVILLE, N. J.—The Borough Council has had estimates made for the installation of a municipal electric lighting plant, and is now considering the various features. The station as planned is estimated to cost about $17,400, and have a capacity of 400 40-candlepower lamps. A.

SOUTH BEND, WASH.—With the filing by Frank McKean of Seattle, of water appropriation rights on the South Fork River and the closing of negotiations with owners of property along the river, the first steps in actual development of 1914 for Willapa Harbor and South Bend have been taken.

VICTORIA, B. C.—The Canadian Power & Land Company has made application to the Dominion Government for a license under the Water Act to divert water from the Cowichan River for hydroelectric power purposes. A 10,000-horsepower plant is to be built about six miles from the outlet of Cowichan Lake. O.

HOOD RIVER, ORE.—The latest step in the movement for cheaper lights in the Hood River Valley was the appointment of a committee to draw up a petition calling for the organization of the lower valley into a municipality for the purpose of establishing a municipal power and light plant.

SPOKANE, WASH.—The Trustee Company has been granted a franchise by the City Council to use city streets for laying pipes, wires, conduits, etc., for steam or hot water heating, and for electricity for light and power, etc. The Company will build a $100,000 plant in this city, plans having been prepared for same. O.

MONTAGUE, MASS.—A meeting of citizens was held March 11 to consider the organization of a lighting district. It is reported that the Franklin Electric Light Company, Turner's Falls, is negotiating to take over the Montague company and supply electricity to the territory at prices somewhat below those now prevailing. W.

MANSFIELD, O.—The lighting equipment of the city will be doubled, according to plans which will be submitted to the Council not later than March 10, by H. Whitford Jones, consulting engineer of Cleveland, who has been

employed as expert by the local authorities. Nitrogen tungsten lamps will be used exclusively. J.

TONOPAH, NEV.—Articles of incorporation have been filed for the Colorado River Hydro-Electric Company with a capital stock of $5,000,000, by Henry C. Smidt, W. R. Williams and William Forman. The company recently secured valuable water rights on Colorado River near the Nevada line.

EVANSVILLE, IND.—The Y. M. C. A. Board of Directors has decided to install its own power plant for the new building now under construction. The building committee composed of Dr. J. C. McClurkin, G. A. Trimble, C. H. Battin, W. B. Miller and A. F. Karges has been authorized by the directors to obtain bids for the plant at once.

SANDY, ORE.—The Portland Railway, Light & Power Company, of Portland, in a recent communication to City Auditor C. D. Purcell announced that $3,000 would be spent in constructing a transmission power cable from Portland to this city. The city has decided to install 12 arc lamps when the improvement has been made.

LAPWAI, IDAHO.—The City Council has granted the application of the Lewiston Light & Power Company for a franchise, permitting the erection of poles and operation of light and power lines through the streets of this city. The franchise is for 25 years, and provides that the light and power must be supplied to this locality on or before July 15 of this year. O.

WORTHINGTON, O.—Bids will soon be called for on the construction of about two and one-half miles of cluster-light posts and wiring to connect this village with nearly the same mileage of lights extending northward from Columbus. When this with other features of the general improvement is completed there will be a splendid suburban boulevard, ornamentally lighted over its entire distance of nearly five miles. J.

COLUMBUS, O.—The electrical features of a new theatre about to be built here are expected to be fully equal to those of the Majestic Theatre, just completed, which cost $4,000 exclusive of the fixtures. The building entire, to be three stories and basement, of concrete and steel, will involve an outlay of $80,000. H. L. Chapman, a millionaire coal man, is the owner, and Dawson & Holbrook the architects. The theatre has already been leased and must be ready to turn over by August 1, 1914. The plans will soon be ready for bidders. J.

NEWPORT, ORE.—A. Welch and C. E. Welch, construction engineers of Portland, who recently purchased the local light and power plant, have announced that extensive improvements will be made at once. A generating station will be installed in Toledo, near here, from which power will be obtained for both this city and Toledo. The construction of a high-power voltage line, on which electric current will be transported to Newport, will be commenced immediately. That the present operations in Lincoln County are significant of great future development is foretold by the probable acquisition of the telephone lines of the county and of a prospective trolley line connecting this city and Toledo. O.

TELEPHONE AND TELEGRAPH.

(Special Correspondence.)

WILSON, N.C.—Carolina Telephone & Telegraph Company will expend $15,000 improving its system.

SANBORN, IOWA.—Sanborn Telephone Company has been incorporated with a capital stock of $20,000. W. H. Barker is president.

OLYMPIA, WASH.—The West Side Rural Telephone Company has been incorporated by C. E. Starr, Marion George and others.

GAGE, MONT.—The North Side Telephone Company has been organized to build about 20 miles of line. Address James Batschelete, president.

JUNCTION CITY, WIS.—Junction City Rural Telephone Company has been incorporated with a capital stock of $2,000 by T. J. Pitt and others.

GENESEE, IDAHO.—A telephone company will be organized here with a capital stock of $20,000. Address R. W. Gillan, of Pullman, Wash., in regard thereto.

DAHLONEGA, GA.—The Caney Creek Telephone Company has been incorporated with a capital stock of $5,000 by J. W. Justus, F. J. Williams and others.

HOODSVILLE, W. VA. — The Hoodsville Telephone Company has been incorporated with a capital stock of $2,500 by W. D. Barb, Lee Swisher and others.

COLUMBUS, O.—The Columbus Citizens Telephone Company, is preparing to extend its lines and general service. Frank A. Davis has been re-elected president of the company.

LITCHVILLE, N. D.—The Gladstone Pearl Lake Telephone Company will branch out to the north as soon as the weather will permit, the line will have a direct connection with Litchville. C

EUGENE, ORE.—The Pacific Telephone Company will build 222 additional miles between Eugene and Albany, to cost $15,450. Address C. P. Van Houte, superintendent, for further information.

ST. CLOUD, MINN.—The Spring Hill Telephone Company has been organized for a rural telephone system for the town of Greenwald. J. J. Winter and Peter Krantz, of Spring Hill, are the incorporators.

DRYAD, WASH.—Charles Roundtree and C. H. Sweeney, of Klaber, are contemplating the installation of an up-to-date telephone system in this city and Doty. It is understood work will begin shortly and be completed in about three or four months. Franchises have been secured in both cities.

BENTON HARBOR MICH.—Estimates have been approved by the president of the Michigan State Telephone Company, covering the replacing of iron wire in the toll-line circuit between New Buffalo and Lakeside with copper wire which will entail an expense of $1,273. Address A. E. Huntley, manager, for desired information.

CHEHALIS, WASH.—The Bunker Creek Rural Telephone Company, and Mary E. Coffman, have made application to the Lewis County Commissioners for a franchise to build a telephone line along certain roads in the western part of the county. The Crego Telephone Company has also applied for a franchise, its territory being southwest of Chehalis.

ELECTRIC RAILWAYS.

(Special Correspondence.)

WINSLOW, ARIZ.—J. F. Mahoney has been granted a franchise for an electric car system in this city.

BRAINERD, MINN.—George Reed is promoting an electric road to connect Brainerd and adjoining towns.

WASHINGTON, D. C.—The Southern Railway, with general offices here, is planning the construction of an automatic electric signal system between Knoxville and Morristown, Tenn. G.

GLOBE, ARIZ.—Articles of incorporation have been filed for the Globe & Miami Traction Company, with a capital stock of $250,000, by Joseph B. Ryan, Charles W. Gift, Jr., and Richard West.

CLARKSVILLE, TENN.—Plans for an electric railway from this point into Southern Kentucky are being made. The proposed line will be 35 miles long. Capt. Edward Martin, Big Rock, Tenn., may be addressed. G.

LAWTON, OKLA.—A franchise to the Lawton Lighting & Railway Company for the use of the streets for street railway purposes was granted at a special election here. The company's plans also include an interurban to Fort Sill. P.

LAWRENCE, KANS.—Hocker & Dixon, promoters of an electric road from Zarah to Lawrence, have announced that work will begin in the spring. C. B. Hosford, who has charge of the right of way work, has secured about half of that between Eudora and DeSoto.

OCALA, FLA.—The board of governors of the Ocala Board of Trade met to discuss the feasibility and devise ways and means of building an electric interurban electric car line from this city to Silver Springs. Address the secretary of the Board of Trade for desired information.

ROCKVILLE CENTER, N. Y.—There are rumors afloat in Rockville Centre that a company will be formed in this village to construct a trolley line to connect Hempstead, Oceanside, Rockville Center, East Rockaway and Long Beach. Several very prominent citizens are very enthusiastic over the project.

ELWOOD, IND.—Articles of Incorporation for the Windfall & Central Indiana Traction Company have been filed. The capital is $10,000, and the purpose is to operate an electric railway from Tipton to Marion, *via* Windfall. The directors of the concern are E. N. Todd, Thomas E. Dean and Guy Dean.

DETROIT, MICH.—Detroiters and others identified with water power plants at Holly and Linden, Mich., are promoting the construction of an electric car line between those cities. Dr. Oliver H. Lau, 693 John Road, Detroit, has applied to the State Railroad Commission for permission to issue $50,000 worth of stock in the company to be incorporated.

MARION, ILL.—The Southern Illinois & St. Louis Railway Company will soon begin the construction of an electric line extending from Marion through Johnson City and West Frankfort to Benton, Ill. After its completion this line will be connected with the Eldorado Carrier Mills branch, the connecting road being built from Harrisburg to Marion. W. H. Schott, of Chicago, is president and general manager.

NEW INCORPORATIONS.

MASON CITY, IOWA.—The Clark Electrical Company has been incorporated with a capital stock of $5,000 by E. J. Clark, O. P. Strickler and others.

QUINCY, ILL.—The Ellington Electric Company has been incorporated with a capital stock of $1,500 for the purpose of manufacturing, dealing in and selling electric apparatus, appliances, etc.

LOUISVILLE, KY.—The Safety Door Securer & Manufacturing Company has been organized with $20,000 capital stock and will require motors for the operation of its factory. G.

BOSTON, MASS.—The Engineering Company of America has been incorporated with a capital of $10,000. The incorporators are Henry E. McDowell, George F. Tarbell and George K. Willard. W.

GARY, IND.—A. B. Harris Electric Company has been incorporated with a capital stock of $20,000 to deal in electrical fixtures. The directors are Arthur B. Harris, Cecilia R. Harris, W. B. Brockhouse.

BOISE, IDAHO.—Garrecht Extensible Electric Light Fixture Company has been incorporated with a capitalization of $50,000. The directors are Frederick Garrecht, E. Straus, William Warner and E. W. Barry.

CHICAGO, ILL.—Bodine Electric Company has been incorporated with a capital stock of $50,000 to manufacture and sell electrical apparatus and machinery. The incorporators are Carl D. Bodine, John P. Bodine and Paul J. Bodine.

YOUNGSTOWN, O.—The Electrical Maintenance Company has been incorporated to engage in general contracting. The capital stock is $25,000 and the incorporators are Max Hain, Samuel Hain, Rebecca Hain, Mark Gunlefinger and Ethel Gunlefinger.

NEW YORK, N. Y.—Electrical Review Publishing Company, Incorporated, has been granted articles of incorporation, capitalized at $450,000. The incorporators are Charles W. Price, Henry D. Lyman and John K. Berry, of this city.

PORTLAND, ME.—Acme Register Company has been incorporated to manufacture, sell and deal in electrical devices or machines for registering, signaling, etc. The capital stock is $500,000. R. A. Worth is president of the company, and E. C. Keith, treasurer.

BUFFALO, N. Y.—Ampere Control Corporation has been incorporated to deal in control systems for autos, aeroplanes, etc. The capital stock is $100,000 and the incorporators are Ernest W. Jones, Ralph E. Heard and L. C. Kinnius, of Buffalo.

BROOKLYN, N. Y.—Acorn Insulated Wire Company, Incorporated, has been granted articles of incorporation for the purpose of manufacturing insulated wire, cable, etc. The capital stock is $100,000 and the incorporators are Walter V. Donovan, Joseph Quittner and Joseph T. McMahon, of New York City.

NORTH PELHAM, N. Y.—Sartiron Utilities Manufacturing Company, Incorporated, has been granted articles of incorporation to manufacture electric and has pressing irons, etc. The capital stock is $100,000 and the incorporators are M. C. Downs, H. D. Downs and L. B. May, all of New York City.

PROPOSALS.

RUBBER-INSULATED CABLE.—Sealed proposals will be received at the United States Engineer Office, Washington Barracks, D. C., until March 16 for furnishing 650 feet 41,700-circular-mil cable on one reel, duplex rubber-insulated and lead-sheathed. For further information apply to Joseph E. Kuhn, lt. col., Corps of Engineers, U. S. A.

ELECTRICAL EQUIPMENT. — Sealed proposals will be received by the Bureau of Supplies and Accounts, Navy Department, Washington, D. C., until March 31, for furnishing 18 portable desk lamps, as per Schedule 6500, two blinker and speed-light controllers, miscellaneous indicators and telegraphs, two blinker and truck lights, miscellaneous contact makers, two telephones, types A, B, C, P and CN, all as per schedule 6507, for delivery at the Navy Yard, Annapolis, Md.; one fire-control system, as per Schedule 6506, for delivery at the Navy Yard, Brooklyn, N. Y., and 200 storage batteries for gun firing, etc., as per Schedule 6501, for delivery at the Navy Yard, Philadelphia, Pa.

NEW PUBLICATIONS.

FUEL BRIQUETTES.—The Bureau of Mines has issued bulletin No. 58 entitled "Fuel Briquetting Investigations," by C. L. Wright. This covers tests carried out during the years 1904 to 1912. It contains much useful information regarding the use of different binding materials and the tests to which the briquets were subjected. The report comprises 277 pages and is illustrated.

FRENCH POWER STATIONS.—The "Annuaire de L'Électricité" has been published by *La Lumiere Electrique* for the year 1914. It contains a list of the central stations operating in France, with details of the voltage, frequency, capacity, etc., and additional chapters covering electric traction companies, manufacturers, officials, legal enactments, colleges, and publications. It constitutes a volume of 440 pages and the price is 80 cents.

ACTION OF ACID ON INSULATION.—The Bureau of Mines has published Technical Paper No. 58 entitled "The Action of Acid Mine Water on the Insulation of Electric Conductors," by H. H. Clark and L. C. Ilsley. This is a premilinary report describing the tests which have been carried out and the results obtained. Rubber insulation was not affected, but with cambric and other special material it was found to open the path for the entrance of moisture.

ELECTROLYSIS IN SPRINGFIELD.—A report on the electrolysis conditions in Springfield, O., by representatives of the Bureau of Standards, the city of Springfield and the public utility companies in that city, has been made to the city manager and published. The committee concludes that the insulated-return-feeder system is the best means of dealing with the electrolysis problem where the tracks are not insulated from the ground. This method should be combined with thorough track bonding so that the resistance of each rail joint is less than the resistance of eight feet of rail. No metallic connections between water or gas pipes and railway return circuits should be permitted. The report includes the results of tests made in determining potentials and potential gradients at various points in the city.

FINANCIAL NOTES.

The annual meeting of the stockholders of the American Telephone & Telegraph Company will be held in New York, Tuesday, March 31, at noon. Books close March 20, and reopen April 1.

J. P. Morgan, & Company, Kuhn, Loeb & Company, the First National Bank and the National City Bank, of New York, offered recently $10,000,000 Central District Telephone Company first-mortgage 30-year five-per-cent sinking-fund gold bonds at par and accrued interest, which were over-subscribed.

The Chesapeake & Potomac Telephone Company of Virginia, a subsidiary of the American Telephone & Telegraph Company, has sold $1,000,000 first mortgage five-per-cent bonds dated May 1, 1913, and due 1943. The bonds are being offered in Virginia and Maryland at 96, to yield over 5.25 per cent.

Consolidation of public-utility plants in seventeen towns near St. Louis was revealed when $100,000 of Southern Illinois Light & Power Company first-mortgage sinking-fund six-per-cent bonds was offered at 100 and interest, yielding six per cent upon the investment. Electric-light and gas plants and street railways are included in the properties. The towns include Hillsboro, Collinsville, Caseyville, O'Fallon, Gillespie, Nokomis, Coffeen, Maryville, Taylor Springs, Witt, Raymond, Harvel and Irving. The corporation has outstanding $300,000 of six-per-cent preferred stock and $700,000 common, with a total of $550,000 first-mortgage six-per-cent bonds out of $5,000,000 authorized.

The Allis-Chalmers Manufacturing Company reports a surplus on December 31, 1913, of $755,124, representing the profits of the company from the beginning of business on April 16 to December 31, 1913. The unfilled orders on hand at the close of the year amounted to $3,350,000. J. H. McClement, chairman of the board of directors, said in the report there had been a decided falling off in business since August 1, in sympathy with the general slackening throughout the country. The result, he asserted, was reflected in a large reduction of profits each month since October 1, and as yet there was no improvement. Directors have voted to defer dividend action "until such time as profits and business prospects will justify the expectation that they can be declared and maintained at a specific rate."

Dividends.

Buffalo General Electric Company; the regular quarterly dividend of one per cent on the common stock, payable March 31, to stock of record March 20.

Central States Electric Company; regular quarterly of 1.75 per cent on the preferred stock, payable April 1 to stock of record March 10.

Chicago City Railway Company quarterly of 2.5 per cent, payable March 30.

Consolidated Gas, Electric Light & Power Company; semi-annual of three per cent on the preferred and quarterly of 1.5 per cent on the common, payable April 1 to stock of record March 20.

Electric Properties Corporation; quarterly of 1.5 per cent on the preferred, payable March 10 to stock of record March 1.

Interborough Rapid Transit Company; quarterly dividend of 2.5 per cent, payable April 1.

Manila Electric Railroad & Lighting Corporation; quarterly of 1.75 per cent,

payable April 1 to stock of record March 18.

Muskogee Gas & Electric Company; quarterly of one per cent on the preferred, payable March 16 to stock of record February 28.

Narragansett Electric Company; the regular quarterly dividend of two per cent on its stock, payable April 1 to stock of record March 7.

Standard Gas & Electric Company; quarterly scrip dividend of two per cent on the preferred stock, payable March 16 to stock of record February 28.

St. Joseph Railway, Light, Heat & Power Company; quarterly dividend of 1.25 per cent on the preferred stock, payable April 1 to stock of record March 16.

United Traction & Electric Company; quarterly of 1.25 per cent, payable April 1.

West End Street Railway Company; a quarterly common dividend of $1.75 per share, payable April 1 to stock of record March 1.

Western Electric Company; regular quarterly dividend of two per cent, payable March 31 to stock of record March 24.

Report of Earnings.

SOUTHERN CALIFORNIA EDISON.

	1914.	1913.
January gross	$ 404,757	$ 397,103
Net after operation	197,067	185,003
Balance after charges.	126,337	118,686
Balance after depreciation	76,337	53,686

CAROLINA POWER & LIGHT.

The Carolina Power & Light Co., which, in addition to the properties owned and operated, also controls all the common stock of Yadkin River Power Company and the Asheville Power & Light Company, reports income account for the year ended December 31, 1913, as follows:

	1913	1912
Gross earnings	$525,213	$446,019
Operation and taxes	334,558	302,488
Net earnings	190,655	143,531
Other income	*50,000	*30,000
Total income	240,655	173,531
Interest	92,453	67,206
Sundry credits	43,183	34,099
Balance	105,019	72,226

*Dividend from Asheville Power & Light common.

The above earnings do not include those of Yadkin River Power or Asheville Power & Light. Carolina Power & Light December 31, 1913, supplied service to 7,813 customers, carried 2,294,201 street railway passengers in 1913 and has approximately 10,000 horsepower of electric generating capacity, with an output of 70,418,900 cubic feet of gas in the year.

PERSONAL MENTION.

MR. RICHARD C. SMITH has resigned as sales agent for the Safety Insulated Wire & Cable Company to become traveling representative of the Bishop Gutta-Percha Company, of New York City, which duties he assumed on March 1.

MR. GEORGE H. HARRIS has been appointed general superintendent of the San Francisco-Oakland Terminal Railways Company, now under process of reorganization under its new owners. Mr. Harris was formerly with the Birmingham Railway, Light & Power Company.

MR. F. N. JEWETT, sales manager of the Wagner Electric Manufacturing Company, has had to temporarily relinquish the duties and responsibilities of his position because of a recent nervous collapse. He will, however, retain his connection

F. N. Jewett.

with the Wagner Company in the capacity of assistant to the executive officers. For the present he will devote his energies primarily to the restoration of his health and vigor, and will undertake only such duties that the state of his health will permit. Mr. Jewett's many friends are gratified to learn that his condition is showing very satisfactory, though somewhat slow, improvement, with the assurance of complete recovery in time. Mr. Jewett is a graduate of Cornell University, class of '93. After graduation he entered the experimental department of the Payne Engine Company, Elmira, N. Y., where he remained until 1895, when he entered the New York sales office of the same company, remaining there until 1896, when that company went out of business. From 1896 to 1899, he was with Evans-Almirall & Company, of New York, as salesman; and from then until 1906 was western manager of the same company, with headquarters in Chicago. In 1906 Mr. Jewett resigned to accept a position with the Wagner Electric Manufacturing Company, as manager of the Chicago district, with Chicago headquarters, and in 1909 was made sales manager, which position he has held to date. Mr. Jewett is a member of the American Society of Mechanical Engineers, of the Society of Heating and Ventilating Engineers, and an Associate of the American Institute of Electrical Engineers.

MR. R. E. RICHARDSON, formerly general manager of the Kansas City Electric Light Company, will shortly return to that city. Mr. Richardson resigned the management of the City Electric Light Company in 1910 to join the Commonwealth Power Company, at Kalamazoo, Mich.

MR. R. E. BRIAN, Louisville manager of the Federal Sign System (Electric), was toastmaster at a banquet given by employees of the company in honor of MR. ROBERT MONTGOMERY and MR. R. E. FLOWER, manager and assistant manager, respectively, of the commercial department of the Louisville Gas & Electric Company, and others. The banquet was given at the Henry Watterson Hotel, Louisville.

MR. HARRY REID, vice-president and general manager of the Kentucky Utilities Company, at Lexington, Ky., has been appointed president of the company, succeeding MR. MARTIN J. INSULL, of Chicago. Mr. Reid's headquarters will continue to be in Lexington. The company operates a number of properties in Kentucky, and is planning putting into effect a power service for a large number of coal mines in Eastern Kentucky.

MR. P. J. KEALY, who recently severed his connection with Bion J. Arnold, the street railway valuation expert, to become assistant to R. J. Dunham, chairman of the Board of Directors of the Kansas City Railway & Light Company, will give all of his attention to the appraisement of the Kansas City Electric Light Company in the immediate future. The stock in this company is held by the Kansas City Railway & Light Company, which also controls the Metropolitan Street Railway Company.

MR. LOUIS R. KRUMM, chief radio inspector of the Bureau of Navigation, Department of Commerce, is touring Southern California, and is making his headquarters in Los Angeles. One of the objects of his trip is to inspect the wireless stations located in Los Angeles, Catalina Island and San Pedro. He is also looking after the amateur wireless operators who are causing the government considerable trouble. Those who can comply with the law will be licensed, while a watch will be kept of the irresponsibles. "The uses of the radio telegraph are so important to the world and humanity that its use should be and will be restricted to those who are willing to comply with the law and take out licenses," said Mr. Krumm. There are 700 wireless apparatus on as many ships, according to this authority on the subject, and 200 commercial stations throughout the country. The Government has just completed the equipment of a station at Arlington that will enable an operator to talk to Mare Island.

CLOSING BID PRICES FOR ELECTRICAL SECURITIES ON THE LEADING EXCHANGES AS COMPARED WITH THE PREVIOUS WEEK.

	Mar. 9	Mar. 2
American Tel. & Tel. (New York)	120⅞	120½
Commonwealth Edison (Chicago)	136¼	136½
Edison Electric Illuminating (Boston)	262	260
Electric Storage Battery common (Philadelphia)	53¼	53⅛
Electric Storage Battery preferred (Philadelphia)	53¼	53¼
General Electric (New York)	146	147
Kings County Electric (New York)	120	120¼
Manhattan Transit (New York)	1	1
Massachusetts Electric common (Boston)	11	11¼
Massachusetts Electric preferred (Boston)	62	61¾
National Carbon common (Chicago)	155	155
National Carbon preferred (Chicago)	115	115¼
New England Telephone (Boston)	138	138
Philadelphia Electric (Philadelphia)	26¾	26¾
Postal Telegraph and Cables common (New York)	84	86
Postal Telegraph and Cables preferred (New York)	69	69¾
Western Union (New York)	63½	63
Westinghouse common (New York)	70¾	70¾
Westinghouse preferred (New York)	116½	115

MR. FRED B. FRESSEN, representing the Luminous Unit Company of St. Louis, is in Salt Lake City covering the trade on the products of this company.

MR. W. W. TORRENCE, manager of the General Electric Company, at Salt Lake City, Utah, left this week for Schenectady, on his regular visit to the home offices of the company.

MR. ERNEST F. SCHETTLER, chief clerk of the Intermountain Electric Company, of Salt Lake City, is back at his desk, after suffering a severe case of small pox, which kept him in quarantine for some time.

MR. C. B. HAWLEY, president and general manager of the Intermountain Electric Company, has returned from a trip East where he attended the Jobbers' Convention at Washington, D. C. While away he visited New York.

MR. BERT H. PECK, formerly associated with the firm of D. C. & Wm. B. Jackson, Chicago, Ill., as electrical engineer, has assumed the position of City Telephone Inspector, in charge of the Telephone Bureau of the City of Chicago. This bureau was created by the Telephone Rate Ordinance passed by the City Council on May 26, 1913, and is invested with the duties of investigating reasonable complaints of telephone service in the city, the enforcement of laws and ordinances relating to telephone service, the analysis of the rules and regulations of the various telephone operating companies in the city, and the collecting and compiling of statistical information regarding telephone service in this and other cities.

MR. E. A. REED, general manager for the receivers of the Central Union Telephone Company, with offices in Columbus, O., has resigned an associate position as general manager of the Cleveland Telephone Company, and will give his entire time to the Central Union, having charge of the Ohio business. MR. ALLARD SMITH, who has been engineer for both companies, takes Mr. Reed's place with the Cleveland concern, and will at once remove to that city from Columbus. MR. ROLLO R. STEVENS, commercial superintendent of the Ohio division of the Central Union, has resigned to enter the service of J. P. Morgan & Company in connection with their Ohio companies, with headquarters in Columbus. His successor is to be MR. W. S. CRATER, formerly in charge of the connecting department of the Central Union for Ohio. MR. A. J. WALKER has been appointed state engineer for the Central Union, to succeed Mr. Smith.

MR VAN RENSSELAER LANSINGH has been appointed manager of a recently organized department in the National Lamp Works of General Electric Company, with offices at the National Lamp Works, Nela Park, Cleveland, and will have general supervision over the manufacture and sale of reflectors, both glass and metal. Mr. Lansingh has been prominent in the activities of the Illuminatnig Engineering Society, in fact was one of its founders. He was general secretary in 1906 and president for the term ending in December, 1912. Since then Mr. Lansingh has also served as treasurer, vice-president and president, and is perhaps in the minds of central-station men more closely identified with the advancement of scientific principles in regard to the use of reflectors of light sources than any other man in this country. Mr. Lansingh graduated from the public schools of New York City, and attended the College of the City of New York from 1888 to 1891. He entered the University of Chicago in 1892, graduated January, 1896. From February, 1896, to June, 1898, he attended the Massachusetts Institute of Technology, receiving the degree of Bachelor of Science in electrical engineering. He joined the testing department of the Western Electric Company in February, 1899, and in July, 1900, formed the V. R. Lansingh Company in Chicago, sales agents for Holophane globes and reflectors. In September, 1904, he was appointed general manager and chief engineer of the Holophane Works of General Electric Company, Cleveland, the headquarters of which have recently been located in that city. In the Johns Hopkins University course of lectures on "Illuminating Engineering." Mr. Lansingh gave the lecture on "Shades, Reflectors and Diffusing Media." Mr. Lansingh has very frequently contributed to the proceedings of the Illuminating Engineering Society, and to the technical press of this and other countries. His book "Practical Illumination," written in collaboration with Mr. J. R. Cravath, has had a very wide circulation and is not only in the library of every man interested in lighting, but has been used in many educational institutions as a text book.

V. R. Lansingh.

OBITUARY.

MR. PATRICK DORE, owner of the lighting plant at Westville, Okla., was shot and killed in that city recently. Mr. Dore was interested in other lighting plants in Oklahoma, as well as the one at Westville.

MR. FREDERICK J. NEWMAN, president of the Chicago Electric Motor Car Company, died at his residence in Chicago, Ill., on March 8, in his thirty-sixth year. Mr. Newman was a member of the American Institute of Electrical Engineers and of the Society of Automobile Engineers. He was born in Milwaukee, was a graduate of the University of Wisconsin, and came to Chicago 10 years ago.

MR. HENRY GREEN, pioneer manufacturer of X-ray tubes, died at his home in Hartford, Conn., on March 4, of carcinoma of the liver induced by X-ray poisoning. He was born in England 54 years ago. He developed the first focus-sign tubes to be successfully operated and gave many public demonstrations, later beginning the manufacture of tubes on a commercial basis. John L. Bauer, a glass blower, who aided in the development of the tubes, died from the same disease in 1906.

MR. EDWARD J. DUNNE, superintendent of distribution for the Public Service Corporation of New Jersey and one of the best known street-railway men in the country, died suddenly while being operated upon in St. James' Hospital, Newark, N. J., March 5. Mr. Dunne began his street-railway experience in Cleveland, O., 30 years ago, later going to Detroit, where he superintended the construction of most of the trolley lines in that city. In 1903 he went to New Jersey. Mr. Dunne is survived by his wife, three sons and a daughter.

MR. BERT CROUCH, assistant sales manager of the Western Electric Company's St. Louis branch, was lost in the fire which destroyed the Missouri Athletic Club at St. Louis on Sunday, March 8. Mr. Crouch recently made his home at the Missouri Athletic Club. He was about 30 years old. He was born and raised in Kansas City and received his education in the public schools there. Eight years ago he joined the Western Electric Company, and made such rapid progress that after two years' experience, he was sent to St. Louis as salesman. Mr. Crouch was widely known because of his athletic prowess. Because of this work, he made his home at the Athletic Club in St. Louis. He has a mother and sister in Kansas City.

DATES AHEAD.

American Railway Engineering Association. Annual convention, Chicago, Ill., March 17-20. Secretary, E. H. Pritch, 900 South Michigan Avenue, Chicago, Ill.

Minnesota Electrical Association. Annual convention, Minneapolis, Minn., March 18-20. Secretary, F. A. Otto, St. Paul Gas Light Company, St. Paul, Minn.

Society of Efficiency, New York, N. Y., April 4-11. Secretary, W. H. Tallis, 41 Park Row, New York City.

American Electrochemical Society. Twenty-fifth general meeting, New York, N. Y., April 16-18. Secretary, Joseph W. Richards, Lehigh University, South Bethlehem, Pa.

Iowa Electrical Association. Cedar Rapids, Iowa, April 23-24. Secretary, H. B. Maynard, Waterloo, Iowa.

Iowa Street and Interurban Railway Association. Cedar Rapids, Iowa, April 23-25. Secretary, H. E. Weeks, Davenport, Iowa.

American Physical Society. Bureau of Standards, Washington, D. C., April 24-25. Secretary, A. D. Cole, Ohio State University, Columbus, O.

Cleveland Electrical Exposition, May 20-30. Manager, William G. Rose, Wigmore Coliseum, Cleveland, O.

Southwestern Electrical and Gas Association. Annual meeting, Galveston, Tex., May 20-23. Secretary, H. S. Cooper, Dallas, Tex.

National Electric Light Association. Annual convention, Bellevue-Stratford Hotel, Philadelphia, Pa., June 1-5. General secretary, T. C. Martin, 29 West Thirty-ninth Street, New York, N. Y.

With the Electrical Manufacturers

The Rateau Steam Regenerator Company, New York City, announces that it has issued a license under Rateau United States letters patent to the Terry Steam Turbine Company to manufacture mixed-pressure turbine regulators.

The C. & C. Electric & Manufacturing Company, Garwood, N. J., announces that the Indianapolis territory will temporarily be taken care of by its Cincinnati representative, F. A. Gaylor, Sixth and Vine Streets, Cincinnati, O.

Westinghouse, Church, Kerr & Company, 37 Wall Street, New York City, engineers, have established a laboratory for the purpose of testing concrete aggregates, waterproofing materials, and for investigating paints and preservative coatings for steel and concrete.

Sangamon Electric Company, Springfield, Ill., has issued a bulletin No. 37 describing its mercury-type direct-current watt-hour meters. This 32-page bulletin is well illustrated, explains the theory of the meters, describes their electrical and mechanical details, and gives their performance characteristics.

Duncan Electric Manufacturing Company, Lafayette, Ind., has prepared a large wall chart on which are illustrated over 30 meters and transformers representing the various types of its products. This chart is a valuable one for reference to show the variety of instruments and apparatus that the company manufactures.

Allen-Bradley Company, Milwaukee, Wis., announces that its Chicago representative, Frank L. Gohl, has removed from 540 Commercial National Bank Building to 307 Webster Building, 327 South La Salle Street, Chicago, Ill. This change was necessitated by a decided increase in business, his old offices proving too small to accommodate the same.

Pittsburgh Reinforcing Pole Company, Pittsburgh, Pa., announces that it has transferred its business to Hubbard & Company and leased to that firm the exclusive right to manufacture and sell Orr reinforcing material under its several patents. This action is due to the desire of Hubbard & Company to make its line of electrical hardware as complete as possible.

Corbett & De Coursey Company, Columbia Bank Building, Pittsburgh, Pa., announces that J. A. Wahlgren, who was formerly connected with the Western Electric Company's branch in Buffalo as assistant salesmanager, has become salesmanager of the Pittsburgh firm. This company is now representing the Flexlume Sign Company, of Buffalo, together with its other lines in the territory contiguous to Pittsburgh.

The Hess-Bright Manufacturing Company, Philadelphia, Pa., has added a considerable number of new data sheets of its series 336. These give detailed diagrams of various bearings with interesting comments on their design and use. Sheet 83A, which is one of the latest ones issued, is devoted to ball-bearing mountings for vertical armature shafts of electric motors. This should prove of considerable interest to motor manufacturers and users.

Wagner Electric Manufacturing Company, St. Louis, Mo., is sending out a little folder pointing out the value of the Wagner rectifier for charging small storage batteries. This device is suitable for connection to any ordinary lighting circuit and charges six-volt or similar storage batteries, such as used for ignition in automobiles. The folder calls attention to the value of electric lighting of an automobile which is facilitated by the use of this rectifier for charging the battery.

Current Electric Company, 22 East Kinzie Street, Chicago, manufacturer of the new electric furnace for heating soldering irons, has made a change in its No. 3 furnace, which is said to be a very desirable improvement. This furnace is now being made double in the form of two cylinders instead of the oval shape, thus conserving the heat. Users of soldering irons are said to be highly pleased with this improved method of heating, and the sales of the furnaces are increasing rapidly.

Holtzer-Cabot Electric Company, Brookline, Mass., is preparing plans for a new factory to be erected on Amory Street, in the Jamaica Plain district of Boston. The building will be about 300 feet long by 80 feet wide, of five stories, with an ell extension. It will be on the line of the New York, New Haven & Hartford Railroad, with excellent facilities for shipping. The company intends to combine its manufacturing activities under one roof. At present it manufactures its specialties in the Brookline works, and its motor department is conducted at Albany Street in Boston.

Columbus Electrical Works Company, Columbus, O., which for the past seven years has been located at Chestnut and Front Streets, has purchased a site at Town and Front Streets, and will put up a building of three stories during the coming summer for its exclusive use. The arrangement will be such that heavy machinery can be loaded inside the plant. The company will be the first in Columbus to have a home of its own built especially to meet the needs of an electrical business. It specializes in motor work and other equipment for coal mining.

New Process Gear Corporation, Syracuse, N. Y., is now erecting a new three-story 40 by 100-foot concrete and steel building to provide additional machinery facilities for spur and bevel-gear work. This new building is to be absolutely fireproof, with brick curtain walls and concrete floors, and will contain entirely new equipment. Among machines already ordered are 17 Gleason bevel-gear generators, 14 Potter & Johnson automatic turret lathes, 6 Gould & Eberhardt bevel-gear blocking machines and 2 Fellows spiral-gear shapers, all to serve as additions to the larger batteries of similar machines now in service in the main plant.

Western Electric Company, New York and Chicago, announces that its sales during the year 1913 totaled about $78,000,000, which is an increase of over eight per cent over the sales in 1912. Orders in the early part of the year were received at a higher rate than that shown for the entire year on account of falling off in business in the latter half of the year. However, the company states that it has added over 4,000 customers during the past year, bringing the total to approximately 6,000. The increase in business applies to telephone companies, central stations and also contractors. The export business of the company in 1913 was the largest in its history.

Sprague Electric Works of General Electric Company, New York, N. Y., has issued catalog No. 329; this is the 1914 catalog of electric fans which comprise an unusually complete line both of Sprague, Lundell and General Electric fans. Desk fans of both stationary and oscillating types, various ceiling and column fans and a number of exhaust fans are included. The Sprague Works has also issued bulletin No. 49,000, which describes portable ozonators manufactured for household and other uses in which a compact equipment is of service. Two types of these ozonators are made, one taking 60 watts and another 75. The construction of these outfits is well explained and illustrated in the bulletin. Price list No. 852 covers the portable ozonators referred to.

H. W. Johns-Manville Company, announces that the necessity for larger space and better facilities to handle increased business compelled the Indianapolis, Ind., and Louisville, Ky., branches of the company to seek larger quarters. The new address of the Indianapolis branch is 408-410 North Capitol Avenue, that of the Louisville branch, 659-661 South Fourth Avenue. Both of these branches will include ample warehouse accommodations, in addition to showrooms for the display and sale of this firm's varied line of asbestos roofing, pipe coverings, insulating materials, lighting fixtures, automobile accessories, etc. In connection with the last-named line, unusual pains have been taken in the equipment of service departments for the benefit of the customers who desire speedy adjustments, repairs or replacements.

Record of Electrical Patents.

Issued by the United States Patent Office, March 3, 1914.

1,088,686. Transmitter for Wireless Telephony. Ditcham, Twickenham, England. The microphone is inductively connected between the antenna and a high-frequency quenched-spark circuit.

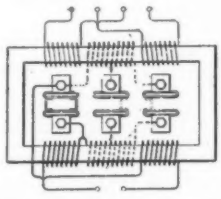
1,088,687. Electric Fan for Railway Cars. E. I. Dodds, assignor to Kerner Mfg. Co., Pittsburgh, Pa. Can be swung into or out of a pocket in the compartment wall, either position being an operating position.

1,088,695. Photographic Apparatus. E. Goldensky and P. H. Bartlett, Philadelphia, Pa. Includes a number of incandescent lamps, first connected in series and then in parallel, the latter connection being made by a switch electro-magnetically operated simultaneously with the camera shutter.

1,088,704. Alternating-Current Regulator. V. E. Johannesen, assignor to General Electric Co. Consists of a special transformer and a reactance in series with its winding, the reactance comprising two coils so connected to the windings that the voltages oppose each other. (See cut.)

1,088,707. Trolley-Wire Connector. J. Kirby, Douglas, Ariz. On either side of an insulating trolley-wheel guard are extensions of the wire terminals.

1,088,708. Telegraph System. I. Kitsee, assignor to American Telephone



1,088,704.—Alternating-Current Regulator.

& Telegraph Co., New York, N. Y. Line currents of opposite polarity represent dots and dashes; the receiving circuit includes a sensitive master relay and a set of polarized relays.

1,088,722. Chandelier. W. Potts, Elkhart, Ind. A telescopic gas fixture with telescopic electric ignition conductors.

1,088,734. Carbon Electrode Having Protective Covering and Process for Producing Same. C. H. Schroers, assignor to Gesellschaft für Teerverwertung M. B. H., Duisburg-Meiderich, Germany. Has imbedded in its surface a protective layer of loosely arranged particles of granular material unaffected by oxidizing gases.

1,088,736. Magneto. L. J. Sevison and L. E. Sevison, Elkhart, Ind. Includes a circuit-breaker frame mounted so as to be oscillated about the shaft for adjustment.

1,088,740. Method of Producing Light. C. P. Steinmetz, assignor to General Electric Co. Consists in producing an arc between terminals, surrounding the arc by an inclosing chamber and modifying the color of the light by the addition of anhydrous iodides of lithium and sodium.

1,088,769. Switch. H. W. Cheney, assignor to Allis-Chalmers Co., Milwaukee, Wis. A double-throw switch.

1,088,771. Electromagnetic Device. W. W. Dean, assignor to Kellogg Switchboard & Supply Co., Chicago, Ill. A telephone ringer with a pair of electromagnets and a tuned reed carrying the armature and hammer.

1,088,776. Lamp Socket. C. E. Godley, assignor to Edmunds & Jones Mfg. Co., Detroit, Mich. For an automobile headlight; includes a plug adjustable with respect to the reflector.

1,088,780. Electromedical Exercising Apparatus. G. J. Katz, Chicago, Ill. One end of a dumb-bell contains a dry cell, the other end an induction coil.

1,088,781. Electric Generator. J. F. Kelly, Pittsfield, Mass. A multicircuit compound-wound dynamo designed to supply independent external circuits with currents of different voltage.

1,088,796. Steering Wheel. C. T. Schroyer, Chester, S. D. The wheel can be electrically heated.

1,088,807. Traffic-Controlling Apparatus. C. J. Coleman, assignor to Hall Switch & Signal Co. New York, N. Y. Sections of the railroad track are supplied with current giving the rails opposite polarity and a stop device carried by the train is actuated thereby.

1,088,814. Railway-Vehicle Magnet and Roadway Therefor. A. H. Fox, New York, N. Y. A car having a magnet device adapted to be drawn by its own attraction toward a roadway armature structure magnetically continuous between control points.

1,088,821. Trolley Head. O. N. Iverson, Hills, Minn. The top of the pole is hinged to the main part.

1,088,838. Combined Reflector and Refractor for Lamps. H. Pickhardt, assignor to Phoenix Glass Co., Pittsburgh, Pa. Has a reflector about the lamp socket and a diffuser and refractor about the body of the lamp.

1,088,839. Bearing for the Shafts of Measuring Instruments. W. H. Pratt and J. R. Fiego, assignors to General Electric Co. Jewel bearing for the lower end of a meter shaft.

1,088,856. Hard Body for Wearing Surfaces and the Like. E. Weintraub, assignor to General Electric Co. A meter jewel formed of a fused body of boron and carbon.

1,088,866. Lamp-Supporting Device. R. B. Benjamin, assignor to General Electric Co. A separable high-tension series socket for street lighting.

1,088,867. Electric Lamp Socket. R. B. Benjamin, assignor to General Electric Co. A modification of the above. (See cut.)

1,088,868. Lamp-Supporting Device. R. B. Benjamin, assignor to General Electric Co. A further modification, including a dielectric supporting plug adapted to be inserted between the lamp and shade.

1,088,869. Illuminated Sign. J. A. Bergmann, Toronto, Ont., Canada. Motor-driven drums formed of glass of different colors are rotated around the lamps.

1,088,870. Relay. J. A. Birsfield, assignor to Stromberg-Carlson Telephone Mfg. Co., Rochester, N. Y. For a telephone switchboard.

1,088,878. Electromagnetic Device. H. P. Clausen, assignor to Stromberg-Carlson Telephone Mfg. Co. A telephone relay.

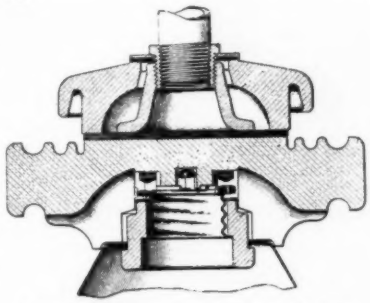
1,088,879. Telephone System. H. P. Clausen, assignor to Stromberg-Carlson Telephone Mfg. Co. Includes a pair of relays adapted upon display of both supervisory signals to sever talking strands of the cord circuit.

1,088,884. Pneumato-Electric Tracker-Bar for Musical Instruments. C. W. Dorriscott, assignor to Electrelle Co., Philadelphia, Pa. Includes movable and fixed electric contacts.

1,088,887. Electrical Heater. G. A. Edmison, and L. Edmison, Los Angeles, Cal. An air warmer with large double-wall vertical tubes having an air space between and a heating coil wound about the inner tube.

1,088,893. Automobile Horn. H. H. Frey, Chicago, Ill. Includes a sounding diaphragm electromagnetically actuated from the alternating-current ignition system.

1,088,897. Electrical Measuring Instrument. K. Gyr, Zug, Switzerland. Includes a prism disposed in an opening so as to reflect the dial reading in a vertically readable image at the opening.



1,088,867.—High-Tension Series Lamp Socket.

1,088,901. Arrangement for Protecting Electric Circuits and Apparatus. P. V. Hunter, Newcastle-upon-Tyne, England. Circuit-breakers at the ends of a section of a power-distributing system with two conductors in parallel are actuated when leakage occurs from either conductor.

1,088,902. Cable for Electric-Current-Distributing Systems. P. V. Hunter. Each conductor of the cable is subdivided into two parallel and symmetrical parts with a thin insulating wall between them so that disturbance in the proportion of the currents carried by the two parts is rendered pronounced through mutual induction.

1,088,907. Process of Manufacturing a Substitute for Vulcanite. E. Knoll, assignor to Metall- und Isolier-Werke G. M. B. H. Meiningen, Meiningen, Germany. Consists in pulverizing a vulcanized mixture of gelatinous regenerated rubber, powdered slate, refuse oil and sulphur, and in vulcanizing the mixture with a caoutchouc substitute, a pigment, oil, wax, resin and sulphur.

1,088,914. Incandescent-Lamp Socket. H. Marks and S. Helsel, Johnstown, Pa., assignors of one-third to W. C. Howland. A locking key socket with rotatable screw shell.

1,088,923. Electrical Sound-Transmitter. M. E. Pearson, Seattle, Wash.,

assignor to Long Distance Telephone Equipment Co. Special construction for long-distance telephone use.

1,088,943. Means for Compensating Tachometers for Temperature Variations. E. M. Thompson, Beloit, Wis., assignor to Stewart-Warner Speedometer Corporation. Thermostatic regulator for a magnetic speed indicator.

1,088,948. Speed-Indicating Instrument. C. H. Warner and A. B. Cadman, assignors to Stewart-Warner-Speedometer Corporation. An electric lamp carried by the casing reflects its light directly onto the dial and pointer.

1,088,963. Electric Conduit. N. W. Buch, assignor to Safety Armorite Conduit Co., Pittsburgh, Pa. A galvanized iron pipe with an interior layer of oil paint and a layer of flexible enamel superimposed thereupon.

1,088,997. Connector Plug. G. C. Knauff, Chicago, Ill. Has a metal shell mounted on one end and electrically connected to one terminal and a central spring contact connected to the other wire terminal.

1,089,030. Electrical Chemical-Testing System. J. E. Angell, St. Louis, Mo. An indicating and recording instrument is in circuit with electrodes to indicate the quantity of chemicals in the water. (See cut.)

1,089,045. Circuit-Breaker. C. E. Carpenter and A. J. Horton, assignors to Cutler-Hammer Mfg. Co., Milwaukee, Wis. An electromagnetic series overload switch with laminated and auxiliary contacts.

1,089,051. Switch Mechanism. W. Herskovitz, Chicago, Ill. For a pull-chain socket.

1,089,077. Electrical Machine. W. A. Price, Teddington, England. Includes a commutator and electrolytic condenser for conversion of direct into alternating current.

1,089,081. Electric-Current Controller. P. J. Ray, Lakewood, O. Includes a compressible resistance column having zero or positive temperature co-efficient.

1,089,091. Receiving Device for Wireless Systems. W. E. D. Stokes, Jr., and G. W. Davis, assignors to W. E. D. Stokes, New York, N. Y. Has an element composed of iron pyrites having carbonaceous shale imbedded therein.

1,089,137. Brush-Lifting Device for Dynamo-Electric Machines. G. H. Krauskopf, assignor to Westinghouse Electric & Mfg. Co. A pawl and ratchet means for moving the brush in the holder.

1,089,138. Guard for Incandescent Electric Lamps. C. A. Lehman and P. A. Lawrence, assignors to McGill Mfg. Co., Valparaiso, Ind. Consists of continuous guard wires and a lamp-socket handle, two of the wires being removably secured to the ring about the socket.

1,089,142. Brush-Lifting Device for Dynamo-Electric Machines. E. Mattman, assignor to Westinghouse Electric & Mfg. Co. A modification of No. 1,089,137.

1,089,146 and 1,089,147. Duplicating Machine. S. A. Neidich, assignor to American Multigraph Co., Cleveland, O. Electric drive and control for the mechanism that feeds sheets of paper between a printing couple.

1,089,167. Starter-Switch for Dual Ignition Systems. G. W. Wacker, assignor to Simms Magneto Co., New York. Includes a push button in line with a spring-actuated contact for moving it into engagement with a vibrating contact.

1,089,180. Socket Shell and Holder Combined. L. W. Andersen, assignor to Plume & Atwood Mfg. Co. Waterbury, Conn. The shade-holder forms an extension of the upper part of the shell.

1,089,181. Speed-Reduction Gearing. V. G. Apple, assignor to Apple Electric Co., Dayton, O. An internal gear for a magneto housed within the machine casing.

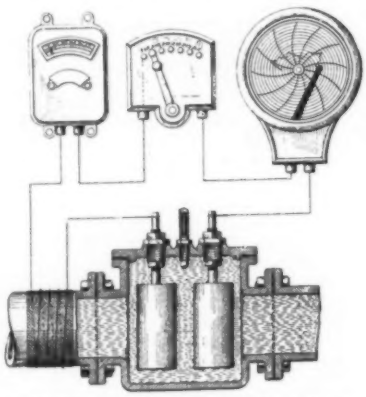
1,089,191. Train-Stopping Device. J. Eirich, Brooklyn, N. Y. Electrically operated semaphore.

1,089,192. Meat Saw. A. E. Erquhart and C. Duclos, Coalinga, Cal. Motor-driven horizontal band saw.

1,089,197. Street and Station Indicator for Cars. A. Fernandez, Mobile, Ala. Motor-driven.

1,089,202. Rail Bond. T. C. Folsom, Tampa, Fla. Special means for upsetting the terminal in the web of the rail.

1,089,244. Spark Plug. J. R. McDowell, Auburn, Ind. Has a dead point adjacent the spark points.



1,089,030.—Electric Chemical Tester for Water.

1,089,256. Spark Advancing and Retarding Mechanism. E. L. Pardee, Marne, Iowa. For an internal-combustion engine.

1,089,267. Automatic Train-Stopping Apparatus. J. M. Roe, Sunnyside, Wash., assignor of one-half to J. Alexander. Includes a sectionalized resistance grid located on the roadway and a train-carried shoe adapted to ride over the grid, gradually cutting out the resistance, so that the controller will operate and bring the train to a gradual stop.

1,089,277. Bed Cooler or Heater. G. F. Shepard, Dodge City, Kans. Includes electric heating coils.

1,089,300. Electric Furnace. C. C. Whitmore, Butte, Mont., assignor of one-half to W. B. Carroll. Includes approximately parallel tubular electrodes with means for supplying cooling liquid, and mechanism for shifting at will one of the electrodes relatively to the other.

1,089,336. Indicator for Measuring or Weighing Machines and Devices. T. W. Fitzgerald, Boston, Mass. Includes an electrically controlled friction clutch-forming mechanism having parts carried by primary and secondary indicating mechanisms to rotate therewith, and means for controlling parts of the clutch-forming mechanism.

1,089,343. Socket Structure for Electric Incandescent Lamps. J. P. Naylor, London, England. A third contact is so arranged as to insert in the circuit an electrical resistance equivalent to that of the lamps, when lamp is removed from socket.

1,089,352. Combined Receptacle-Cover and Shade-Holder. F. W. Wakefield, assignor to F. W. Wakefield Brass Co., Vermilion, O. A combination of an electric lamp receptacle, a cover adapted to detachably engage the sides of the receptacle, and a shade-holder detachably secured to the receptacle.

1,089,359. Treating Petroleum Oils with Ultra-Violet Light. C. Ellis, Montclair, N. J., assignor to Ellis-Foster Co. Comprises process of removing fluorescence of heavy oils by exposing same in thin layers to action of high-voltage ultra-violet light at temperature below decomposition point.

1,089,384. Electric Braking with Alternating-Current Motors. E. F. W. Alexanderson, assignor to General Electric Co. Means for operating series motor as a braking generator comprising a transformer and leads connecting the motor armature.

Reissues.

13,693. Automatic Block-Signaling System. D. J. McCarthy, assignor to Union Switch & Signal Co. Original No. 867,563, dated Oct. 1, 1907. An alternating-current system including a slot magnet, a reversing relay, and an auxiliary device controlled by track circuit for maintaining the circuit of the slot magnet while relay is reversing.

13,694. Engine Valve-Gear. R. C. Stevens, assignor to Skinner Engine Co., Erie, Pa. Original No. 1,072,786, dated Sept. 9, 1913. The combination of a steam engine cylinder, an exhaust valve, electric devices for operating the valve and automatic means to control this operation.

Patents Expired.

The following United States electrical patents expired March 9, 1914.

578,345. Thermal Circuit-Closer. H. F. Maxim, Norfolk, Va.

578,380. Call-Ringer for Telephones. J. A. Wililams and S. Abbott, Cleveland, O.

578,386. Telegraphic Register. C. E. Beach, Binghamton, N. Y.

578,420. Electric Gas-Lighter. F. N. Pike, New York, N. Y.

578,422. Device for Operating Signals. S. S. Bogart, Schraalenburg, N. J.

578,430. Electric Meter. E. Thomson, Lynn, Mass.

578,464. Contact Finger for Electric Controller, E. C. Parlham, Johnstown, Pa.

578,471. Electrical Cane. W. N. Sherman, Merced, Cal.

578,520. Telephone Transmitter. N. Lombard, Boston, Mass.

578,539. Trolley Support. E. Blamey, Jersey City, N. J.

578,595. Electric Lamp Post. J. Buckner, Boston, Mass.

578,611. Electrotherapeutic Syringe. J. D. Rively, Pittsburgh, Pa.

578,643. Electric Cutout. D. B. Kinch, Pittsburgh, Pa.

578,670. Telephone. J. Weigel, Boston, Mass.

578,673. Magnetic Apparatus. A. Boetcher, Philadelphia, Pa.

578,695. Turn-Button for Electrical Switches. J. S. Gibbs, Hartford, Conn.